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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 45

Natural Gas in Ohio—Notes.

Recent Patent Issues 46

Twenty-ninth Annual Meeting, Western Gas Association—Official Report—Revised by the Secretary—Continued from page 12. 46

First Day, Afternoon Session—Some Brief Notes on Capacities of Water Sets, by Mr. Rollin Norris—Discussion—*The Utilization of Tar in a Water Gas Apparatus, by Mr. George H. Waring—Discussion—First Day, Evening Session—Lecture by Dr. William H. Tolman on Industrial Betterment—Second Day, Morning Session—Notes on Carbonization, by Mr. W. E. Hartman—Discussion—Firing of Retort Benches by Battery Producers, by Mr. Fred. Bredel.

The Vertical Retort from a Practical Point of View, by Mr. Ernest Körting 55

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 57

Mayers Gets Columbus Contract—Gas Union—Los Angeles Rivalry—Removing Meters—Lowell's Garden—Jamestown Gas—Bangor Wants Gas Stocks—Ardmore, I. T., to Have Gas—Ambrose, Cal., Sells Franchise—Fort Wayne Gas Company in Hands of Receiver—Three Rivers Fooled—Weatherford to Have Gas—Akron's Franchise—New Orleans Dividend—Wichita Explosion—Gas Savers Incorporated—Cleveland Non-Merger—Man Suffocated—Boston Indifference—And Many Other Items.

The Market for Gas Securities 59

BRIEFLY TOLD.

NATURAL GAS IN OHIO.—After more than a decade of continued supply of natural gas in Ohio, the outlook for its future production for this territory is as bright as ever. Those cities supplied at first by the Fostoria field were subsequently supplied from Canada via Detroit, then from the West Virginia fields. The territory around Columbus was supplied by the Sugar Grove fields, which are still producing; this same territory however, is not only supplied by these fields but in very large quantities from the Licking Connty field, Ohio, the quantity being so great that it warrants the laying of a large main into Cincinnati. Every year sees a new Ohio town supplied with natural gas and the output in that State is far greater now than a few years ago. Ohioans have been schrewd enough to take advantage not only of their own supply of natural gas, but also to import it from the neighburing States, such as Indiana and West Virginia, the former now barren, but the latter is considered the greatest gas reservoir in America. From this underground natural gas laboratory billions of feet are being piped to Cleveland and other important cities, and at this writing it is proposed to put in an 18-inch line under 400 lbs. pressure to supply Cleveland with this commodity from West Virginia, and also at this juncture we hear of the proposed consolidation of the manufactured gas plants at Cleveland. When one looks around and observes Columbus, Akron, Springfield, Zanesville, Newark and other important Ohio cities, all using natural gas, practically to the exclusion of manufactured gas, it is discouraging to the owners of artificial plants in this vicinity, particularly as distance from the source of supply seems to affect but little the transmission of this product which supplies its own pressure. It must not be supposed, however, that everything is lost to the manufactured gas interests when natural gas looms up, for these old Ohio towns possess valuable franchises which can hardly be duplicated in any city. As natural gas is not being produced, as far as it is known, at the present time, it is to be expected that the day will come when these sources will fail, although it does not seem to be in the immediate future, and when that time comes the manufactured gas plant franchises will be extraordinarily valuable as there is no better teacher for the use of gas than the use of cheap natural gas. Bearing these conditions in mind, every effort should be made to keep these old franchises alive.

NOTES.—

THE Richmond Council Committee did not report in favor of Mr. Evans or anyone else, as we reported last week; and Mr. Egner's bid was $8,500 to "make plans and specifications for modernizing the works and superintending the execution of same from start to finish," or $300 per month, and clerk, as long as the work lasted.

THE Columbus Gas and Fuel Company, of Columbus, O., retained Mr. J. Alex. Mayers, of New York city, to report on the situation regarding the manufactured gas interests. His recommendations, which were adopted by the Board of Directors were as follows: The abandonment of the old plant now located in the center of the town, on valuable land. The erection of a small coal gas plant near the holder at the west end of Montgomery street. The reduction of leakage by the cutting off of dead services and mains. Mr. Mayers was subsequently awarded the contract for the coal gas plant, including buildings, etc.

AT Mr. Fred. Thomas' funeral there were 30 gas engineers present. There were few men in the material business who were as popular as "Fred." with the New England men.

MRS. HELEN ARMSTRONG, of Chicago, Ills., well known to the gas fraternity, has just concluded a series of cooking lessons at Lebanon, Pa., where she brought new light into homes that have been using gas for many years. Result, sale of many "cookers."

NORWICH, CONN., is in the market for 4 benches of half-depth 6's.

THE Seneca Edison Company, of Seneca Falls, N. Y., has made application to the State Commission of Gas and Electricity for permission to consolidate with the Geneva Power and Light Company. There will be a hearing on the subject at the meeting of the commission which is to be held in the capitol at Albany July 6. It is understood that the Geneva Light and Power Company is under practically the same control as the Interurban Gas Company, which operates here under the name of the Seneca Falls and Waterloo Gas Light Company. If the State Commission grants permission, the lighting interests here would probably be brought under the same control.

THE United Gas Improvement Company, of Philadelphia, Pa., has completed the purchase of a majority of the stock of the Dauphin County Gas Company. The latter has its offices and plant at Steelton, and supplies gas to all the towns in Southern Dauphin county, and also several in Cumberland county. The Company is capitalized at $162,000. It is said the United Gas Improvement Company will make no changes in its official staff, C. H. Geist, of Philadelphia, being retained as President, and Jonah G. Diffenderfor, of Steelton, as Manager. It was also rumored that the Wyoming Valley Gas and Electric Company, of Plymouth, Pa., was included in the U. G. I. purchase, but there is some uncertainty as to the authenticity of the report.

THE gas plant at Fairfield, Ia., which had just been completed, was almost destroyed by fire. The holder was saved by breaking a gas main some distance away and letting all of the gas out.

J. W. MURDOCK, who has been District Manager for the Western United Gas and Electric Company, with headquarters at Joliet, Ills., has resigned that position and accepted the office of Superintendent for the Associated Gas and Electric Company, of Ithaca, N. Y. In his new

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position he will have charge of the manufacture and distribution in 11 plants situated in New York, Pennsylvania and Ohio.

THE plants of the Sedalia (Mo.) Gas and Fuel Company and the Sedalia Electric Light and Power Company were sold to Edward M. Dean & Co., of Grand Rapids, Mich., and E. H. Gay & Co., of Boston, Mass.

MAYOR HUGO and Attorneys Bolger, Moore and Yost, of Watertown, N. Y., were named as a special committee to employ an expert to investigate generally the city's interests in the consolidation of the Watertown Gas, Light and Electric Company and the Watertown Light and Power Company.

THE recent purchasers of the Lansing (Mich.) gas plant have organized the Lansing Fuel and Gas Company, capital $700,000, to double the capacity. C. H. Geist, of Philadelphia, is General Manager, Charles B. Kelsey, of Grand Rapids, President, and C. H. Pitcher, Secretary.

THE election of a Superintendent for the gas works of Richmond, Va., will be discussed at the forthcoming council caucus, and Superintendent Knowles will probably find several candidates in the field for his office. Some of the Councilmen favor employing an expert engineer to succeed Mr. Knowles; others favor the promotion of Joseph M. Shelton, first assistant superintendent, to the position now held by Mr. Knowles. Mr. Shelton is not an avowed candidate, but his friends say he would accept the office if it were tendered to him.

ON application of the Illinois Trust and Savings Bank and William H. Henkle, of Chicago, Ills., Judge Anderson of the Federal Court recently appointed Charles E. Ruger, of Muncie, Ind., receiver for the Muncie Gas Light and Fuel Company. The amount of receiver's bond was fixed at $20,000.

THE Williamsport (Pa.) Gas Company's controlling interests have been sold, and the probability is the remainder, held by Williamsport persons, will go with the majority to a New York company.

THE New Bern (N. C.) Lighting and Fuel Campany, of New Bern, has been organized to own and operate gas and electric plants in and near New Bern. The capital stock authorized is $100,000, shares $100 each, and the Company begins with $15,000 paid in. The incorporators are J. H. T. Martin, of Glenridge, N. Y.; H. D. Wood and A. D. Ward, of New Bern.

TAMPA, FLA., will make very extensive improvements this year, and are likely to install a water gas set and purifiers as part of the new installation.

AN order removing the stay in the second suit of the Atlantic City (N. J.) Gas and Water Company against the Consumers Gas Company, was made by the Supreme Court in session in Trenton. This means that the Consumers Company may now go ahead and fulfill its contract for lighting the city.

MR. ALEXANDER WYNESS, JR., has resigned from the Superintendency of the Geneseo Gas and Electric Light Company, of Geneseo, N. Y., with the intention of taking up a similar position with a gas, electric light and electric railway syndicate, with its headquarters in Michigan.

THE Galveston (Tex.) Gas Company is being hampered to a considerable extent in the improvements contemplated and now underway in the grade raising district, as well as in the new ground south of Broadway. It appears that the water with which the sand was impregnated while being pumped into the area to be raised has not evaporated to any great extent. Consequently, when an excavation is made in that district the seepage of water is so great as to prevent the rapid construction of any pipe line work.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 10 cents.

822,246. Gas producing apparatus. Julius Bueb, Dessau, Germany.

822,353. Incandescent gas fixture. William T. Donnelly, New York, City, assignor to General Gas Appliance Company, same place.

822,373. Process of purifying burner gases. Rudolph Knietsch, Ludwigshafen-on-the-Rhine, Germany, assignor, by mesne assignments, to General Chemical Company.

822,374. Gas heating device. Victor Kost, Chicago, Ills.

822,394. Revolting kiln for generating gas. Sven E. Sieurin, Hogeans, Sweden.

822,465. Gas burner. William S. McElwee, Yardley, Pa., assignor to General Manufacturing and Supply Company, Trenton, N. Y.

822,484. Gas cock. Jacob Schmidt, Newark, N.J.

822,486. Regenerative gas furnace. Frederick Siemens, Dresden, Germany.

822,531. Process of manufactursng gas. Leon P. Lowe, San Francisco, Cal.

822,771. Gas mixer. Oscar Robbel, Kenosha, Wis.

822,781. Charging door for gas prodecers. Harry F. Smith, Lexington O.

822,871. Burner for incandescent gas light or for heating purposes. Isaac Schoob, London, England.

[OFFICIAL REPORT—REVISED BY THE SECRETARY—CONTINUED FROM PAGE 12.]

THE TWENTY-NINTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD IN CLEVELAND, O., MAY, 16, 17 AND 18, 1906.

FIRST DAY—AFTERNOON SESSION.

The President—I regret to announce that the lecture on Engineering of Illumination, by Mr. Lansingh, will of necessity be postponed until to-morrow morning at 11 o'clock. Mr. Lansingh's slides have not yet been received. To take the place of that lecture this afternoon, Mr. Rollin Norris has kindly consented to present his paper on

SOME BRIEF NOTES ON CAPACITIES OF WATER GAS SETS.

You will give Mr. Norris your attention, gentlemen.

In preparing these notes on the capacity of water gas sets, I have assumed that the apparatus under consideration is of the ordinary Lowe type, where the blast products are used to heat checkerwork for the fixing of oil vapors during the subsequent run.

High capacity is a virtue in a set where it can be obtained without a corresponding sacrifice of other efficiencies, and there may frequently arise emergency conditions where, even at the sacrifice of some efficiency, it is desirable to be able temporarily to run up the capacity of a set.

Ignoring for the moment the limiting effect of the capacity of the fixing vessels for handling oil, let us first consider the general principles underlying the action of the generator, and see in what direction modification of methods tends to increase capacity. In such a discussion it will be necessary to mention a number of things which are elementary, and, in a sense, self-evident.

The making of blue water gas in a generator divides itself into two stages: First, the blow, during which the heat is stored in the fire, and second, the run, during which heat is abstracted from the fire by the decomposition of steam. Each step takes time, and to increase the capacity of a set, the rate of storing heat during a blow, or the rate of abstracting heat during a run, or both, must be increased.

With a set in proper balance, the amount of heat stored per minute of blow varies approximately with the amount of coal burned per minute of blow, and this in turn varies approximately with the amount of air forced through the fire per minute. In other words, increased capacity depends upon increased volume of air, and until other limiting conditions are reached, the more air that is passed through the fire per minute, the greater the capacity of the set.

The rate at which air passes through a given fire depends not upon the pressure under the grate, but upon the difference in the pressures above and below the fire and the mechanical condition of the fuel bed, and the amount of air passing through the fire per minute may be increased by increasing the pressure under the fire, or decreasing the pressure above the fire, or by decreasing the internal resistances of the fire bed itself.

Increasing the pressure under the grate costs money in the form of increased boiler fuel to maintain extra blast pressure, and consequently the most economical way of increasing the blast head, or the difference between the pressure under the fire and on top of the fire, is to decrease the pressure on top of the fire by reducing as much as possible the resistance from the top of the fire to and through the stack valve.

The pressure on top of the fire is made up of the following resistances:

(a) Loss in passing through the connections between the shells.

(b) Loss in passing through the stack valve.

(c) The loss in passing through the checkerwork itself.

The resistances of the connections between the shells and the resistance of the stack valve are not useful, and should be reduced to a reasonable amount by making these openings large, the only limit being a structural one. But the resistance of the checkerwork is a necessary evil, and cannot be reduced below a certain or uncertain amount without unduly sacrificing the efficiency of the checkerwork as a fixing agent.

As an illustration of the effect on capacity of decreasing the resistance beyond the fire, I might mention the case of the 7-foot 6-inch set with a fire 5 feet 6 inches in diameter. About 15 years ago these 7-foot 6-inch sets had a capacity of somewhere around 350,000 feet per day, and an investigation of the blast conditions showed a resistance of about 6 inches under the stack valve, which at that time was made only 8 inches in diameter. The connections between the shells were also very small, with the result that although we carried 18 inches

blast pressure under the grate, the blast head was very low, and the amount of air passing through the generator per minute was low, with a corresponding low rate of make.

These sets now have very much larger connections between the shells, and the stack valve is 18 inches in diameter instead of 8 inches as formerly, and this set now makes, with no increase in pressure under the grate, over 700,000 feet per day, or more than twice as much as it formerly did.

One of the conditions of high capacity may, therefore, be summed up in the expression, "more wind;" but the rapid abstraction of heat during the subsequent run must also be considered, as when a set is running in proper balance, the heat abstracted from the fire during the run is equal to the amount of heat stored in the fire during the blow, and it is evident that increased blast must be accompanied by a corresponding increase in the rate of steam admission, or in the proportion of steam decomposed, or in the length of time devoted to the run. As increasing the length of the run and maintaining the old small supply of steam to the generators is a waste of time, and therefore of capacity, the size of the steam connections to generators has been largely increased, corresponding to the increased supply of air. But there is another element of which sight must not be lost. The actual steam decomposed in making 1,000 feet of carburetted water gas is about 15 pounds, whereas the amount of steam introduced into the generator is about 30 pounds per 1,000, or about double the amount decomposed. With a given fire of a given temperature there seems to be a limit to the rate at which it will decompose steam, and after a certain point is reached any higher rate of steam admission is not followed by any largely increased rate of make. Beyond this point, flooding the fire with steam simply reduces efficiencies, due to the cooling off of the fire in heating up the excess of steam passing through it.

But it appears that the hotter the fire is the greater the quantity of steam it can decompose per minute, and consequently, for the maximum rate of heat absorption during the run, the fire should be as hot as practicable at the beginning of the run, and the run should be cut off before the fire cools down to such a point that the rate of steam decomposition has materially decreased.

The conditions, therefore, making for a high capacity during the run are a sufficient supply of steam, a high temperature of fire and a short run.

Stopping the run while the fire is still hot means that at the beginning of the blow the temperature of the fire is high, and the blow must be correspondingly short in order to avoid excessive fire temperature and a serious formation of clinker. This formation of clinker not only cuts the capacity of the set by increasing the time required for cleaning the set, thus reducing the effective working hours of the apparatus; but it has a still more serious effect on the set capacity by increasing the resistance of the fuel bed to the passage of the blast, with a corresponding reduction in the amount of air passing through the fire per minute of blow.

As explained above, high capacity requires a high fuel bed head, but high fuel bed head may be caused not only by high initial blast, or by low resistances after the fire, but by excessive resistances in the fire itself. It is therefore necessary to steer between two limits. The clinker must be kept down by avoiding excessively high temperatures at the end of the blow, and the run must be stopped while ehe fire is still fairly hot. These conditions, therefore, limit the range in temperature between the beginning and end of the blow, and a determination of the most economical working conditions has to be fixed by actual trial.

The time consumed in changing valves, in putting fuel in the generator and in cleaning the fire, reduces the actual working hours of the set by the time thus occupied, and it follows, therefore, that the mechanical arrangement of the set should be such as to allow these operations to be accomplished with a minimum expenditure of time. An inconvenient arrangement of clinker doors, or an improper adjustment of blast and steam conditions, causing undue formation of hard clinker, may easily run up the clinkering time an extra half hour twice a day, which would be equivalent to the loss of an hour's actual running, or nearly 5 per cent. decreased capaclty.

In summing up the foregoing, we have the following as conditions of high capacity:

1. Rapid rate of passage of air through generator during the blow, this being accomplished by high pressure under the fire, low pressure on top of the fire, and a fuel bed resistance which is kept as low as practicable.

2. The avoidance of excessively high temperature at end of blow, which would cause clinker and increase the internal resistance of the fuel bed to the passage of the blast.

3. High temperature of fire at end of run, so as to stop the run before the rate of make has unduly decreased.

4. Conditions 2 and 3 call for a short blow and a short run.

5. A sufficient supply of steam during the run.

6. A good clean fire, offering as little resistance as possible to the passage of the blast.

7. Proper mechanical arrangements for making the valve changes and cleaning the fires with a minimum loss of time.

In the above notes we have considered principally the conditions making for the maximum capacity of the generator for making blue gas, but have alluded incidentally to the limiting effect of the capacity of the fixing vessels for handling oil.

A given set of fixing vessels, filled in any given way, has some particular distribution of heats at which it will fix with maximum efficiency a certain amount of oil per minute. Any marked increase or decrease in the amount of oil introduced per minute will call for a corresponding increase or decrease in the temperature of the fixing vessels, with, at the same time, a falling off in oil efficiencies.

It takes time for the bricks to absorb heat from the gases burning around them, and where the generator conditions are modified so as to increase the amount of blue gas made per minute, with a corresponding increase in the amount of oil to be fixed during the run, it called for increased temperature in the fixing chambers as explained above. This increased temperature of the fixing vessels must be obtained either by increasing the temperature of the gas burning around the bricks during the blow, or increasing the time devoted to heating the bricks. As the temperature of the burning gases cannot readily be increased, it follows that higher carburetter heats mean, normally, a longer blow, which often results in the fire reaching the desired temperature before the fixing vessels are properly heated. This results in a waste of time, tending not only to reduce the generator fuel officiencies, but also to cut down the capacity of the set by unduly prolonging the blow.

Winter time, when the oil per 1,000 feet required to deliver the standard candle power to the consumer is the highest, is also the time when high capacity is usually the most useful, but to maintain efficient oil results the daily capacity of the set must be correspondingly reduced, so as not to overwork the fixing vessels.

As our sets are now constructed, therefore, it would appear that the limit of capacity lies rather in the requirements for economically fixing the oil than in limitations of capacity of the generator itself.

It is just possible that some modification in our methods might be made which would enable the combustion of the blast gases in the fixing chambers during the blow to be concentrated at the points needed, thus enabling us to get the required temperature more rapidly; or some change in the dimensions or material of the checkerbricks themselves might be made which would enable the checkerwork to absorb heat and give it off more rapidly than with the present construction.

The large proportion of the cost of oil per 1,000 to the total cost of the gas makes the question of oil efficiencies one of supreme importance, and it would require a very large increase in capacity to justify any considerable accompanying reduction in oil efficiencies.

It follows from the above that the maximum capacity of a Lowe set is obtainable when making comparatively low candle power gas, as, under such circumstances, the apparatus can be worked more nearly up to the capacity of the generators.

The extent to which a set is pushed for capacity also affects materially the generator fuel per 1,000, and, as a general proposition, my own experience would indicate that the net economical capacity of a water gas apparatus of standard construction is approximately 10 per cent. below its maximum capacity.

Discussion.

The President—You have heard the reading of Mr. Norris's paper. It is open for discussion. I have here a contribution from Mr. Slade, of Hartford, which I will read.

Mr. Slade (read by the President)—Mr. Norris, in his interesting paper, brings out clearly a fact that is not given the amount of attention that it deserves, that the efficiency and capacity of a water gas set depend not only on the care and skill of the operater but as well on the design of the apparatus. The gas superintendent depends to a great extent on the manufacturer of apparatus for design and the working out of details, the extent of this dependence, of course, varying with the skill and experience of the superintendent. It will be granted that the operator is better able to judge as to the correctness of design than the manufacturer, and this fact will suggest the desirability of the co-operation of operator and builder. It will pay certainly for the

apparatus builder to devote more attention to his apparatus after it i turned over complete than is done at present in many cases. On the other hand the operator will do well to call attention to points of design that may be changed and produce better working. It will be urged that the manufacturer does follow up his apparatus, but is this done to the extent that it should be? Is the following up not wholly confined to glaring and quickly developed defects? Mr. Norris cites the example of the increase in capacity of a 7 feet 6 inches set traceable almost entirely to change in design. The changes were undoubtedly suggested by on operator. The result has been that the gas company obtains more for its money and the apparatus builder furnishes more for the same return with the same margin of profit. It would seem that if the gas engineer and the constructing engineer maintained closer touch that this keeping in touch would result in better apparatus, reduced cost of production with consequent reductions in selling price and following this increased output and greater demand for apparatus.

The President—Mr. Chollar, will you take part in the discussion of Mr. Norris's paper on "Capacity of Water Gas Sets?"

Mr. Chollar—Mr. President, the paper by Mr. Norris, if it had been written by somebody else, would be considered a remarkable paper, but considering its source it is very ordinary. Mr. Norris can write papers like that every day. He takes them out of stock, I think. It certainly has got the whole thing right there, undoubtedly it has the whole thing right there, and the only thing that I could say in regard to it would be that it suggested to me some experiments that we made in St. Louis some years ago in order to determine the relative resistance, you might say, the fuel bed resistance, cold and hot. We fitted up a generator about 30 inches in diameter, and had 5 feet area; we played with that for a good while, and we got some quite interesting experiments there, but unfortunately the full notes have been mislaid. I can remember about the gist of the thing, and where it bears on Mr. Norris's paper. We wanted to find out what was the relative area forced through the fire bed, hot compared with cold, and for that purpose we built the generator at about 5 feet area. It was 30 inches, I think, in diameter. We connected a blower with that, and we had electric power, so that we could get a speed correct, uniform. Of course, the suggestion would be that in any blower there is a certain area, which might be called the capacity area, at which area the blower is able to maintain the pressure constant. If that area is increased the pressure will drop, but the volume of air would be increased. Now, the opening, the generator, was large enough so as to maintain a constant pressure against the fuel bed when the fuel was cold. The fuel bed was probably about 7 feet deep, and the pressure when cold, at the highest speed we ran, represented about 40 to 42 square inches up through the cold coke. We had a square gate, rectangular sheet iron gate, between the main valve, back valve, and the shelf, which slid vertically right down. That was gated off in inches. As I said before, when we blew cold air in, it took about 40 inches to maintain the full pressure, about 12 inches deep. We started the fire, and as the fuel bed got hotter and hotter we could shut down that gate, and when it got to the full highest temperature the last gate was open only 12 inches in area and maintained the full pressure each side of it. It shows, as Mr. Norris said, why the temperature is so much lower above, where the carbonic acid is converted into carbonic oxide, which acts as a reducing agent and cools down the fire at the top, and which also corresponds with Mr. Rugby's paper that he read before the American 3 years ago, that in blowing up the furnace the carbonic acid was not found much above 2 feet. Now, it is well known that the oxygen in converting carbonic acid into carbonic oxide is doubled, so far as the carbonic oxide is concerned the volume is larger and the gas would be one-fifth bigger when it was being converted into carbonic oxide than carbonic acid. Now take high temperature and one-fifth increase in volume. The high temperature that would be found just above the grate bars would be found about 1,550° at the top of the fuel bed, but it is probably pretty nearly double that at the highest temperatures, which would account for the small area of blast opening that was necessary to reduce it from 14 inches down to about 12, and show that to increase the blast for a much larger capacity would require a very much greater increase in the pressure through that opening of only one-third—less than one-third. I don't know whether I have explained the experiment clearly or not, but I have not had the figures. It corresponds altogether with Mr. Norris's figures.

The President—Mr. Dewey?

Mr. Dewey—The paper by Mr. Norris is certainly an interesting one and along lines of established practice. I have no criticism or suggestion to make.

The President—Is there any further discussion on Mr. Norris's paper? Mr. Elbert.

Mr. Elbert—Mr. President, Mr. Norris speaks on page 127, the second paragraph, of increasing the connections on the shells. I think he has overlooked one very particular point and that is the outlet, as that should be a liberal pipe after passing the scrubber or the washbox—that is, between them and the relief holder. I know of cases, especially in our own city, where the outlet is very small. I believe that on an 11-foot machine a 30-inch outlet between the scrubber and the relief holder would increase the capacity of those machines fully 25 to 30 per cent. Again, on page 130, speaking about the capacity of the set in the winter time, he says that "to maintain efficient oil results the daily capacity of the set must be correspondingly reduced, so as not to over work the fixing vessels." I quite agree with Mr. Norris on that point. I have always made it a practice to superheat or try to superheat the oil before it enters the machine. Trying to superheat the oil by putting the pipe down through the outlet from the superheater I consider very bad practice. That pipe very soon becomes covered with lampblack, which is a non-conductor, and your oil will not increase in temperature. I have had it go into our machines with frost on the pipe (in the coldest weather) after going through this so-called pipe superheater. Instead of that we heat our oil with a separate coil in a cylinder. This cylinder is covered over with asbestos or a good non-conductor, and heated with steam. This will give the full capacity of the outlet pipe from the superheater and increases the capacity of the machine.

Mr. Chollar—Mr. President, there is one other thing. Mr. Norris speaks about recommending liberality in the valve connections too, especially the back valves. We made some calculations in regard to some construction, and we found that with our calculations it would almost require to leave the whole top off the superheater to let the gas go through, so that it is certainly beyond any practical construction that we could make.

Mr. Gimper—I have been very much pleased in reading Mr. Norris's paper. I was at home when I read it, and I enjoyed it very much. I wanted the paper to do the most good it could, so I gave it to our gas maker to read, and I told him to take it and study it. I have quite an intelligent man for that purpose.

Mr. Macbeth—In connection with what Mr. Norris said about sets being in balance, I should like to suggest that as a rule I have found that low makes and poor results go together. There is a man I know who used to say that the only way to get results from a water gas set was to make gas, meaning running up to capacity and that is very often true. I know of going into works where they were trying to improve results, and had been for quite a long while, and where they were using very low blast, had gone from a higher blast to a lower blast. If they had gone the other way, increased from a medium blast up to a very high blast, all their troubles would have been over. I don't mean by that that a high blast is right with all fuels but I mean the error is usually made in the low blast and corresponding low make.

The President—If there is no further discussion I will ask Mr. Norris to close.

Mr. Norris—I feel rather complimented than otherwise by Mr. Chollar's rather doubtful compliment.

Mr. Chollar—I beg your pardon. It is the highest compliment I could give.

Mr. Norris—I realize it is not worthy of me, and I might have done a great deal better had I known how. But, joking aside, this is not supposed to be a very elaborate paper; it is intended to be a simple presentation of basic facts.

Mr. Chollar—It is all there, all the same.

Mr. Norris—Mr. Chollar has spoken of what we call the "blast area" of a set, that is——

Mr. Chollar—The blast area of the blower—of the fan.

Mr. Norris—I understand that Mr. Chollar was talking about the equivalent area of a set; that is, the opening which would pass the same air as the generator does if we put the same difference in pressure on the two sides of it. Now, as a set gets dirty, the blast area undoubtedly decreases, so that with a given pressure under the grate (which is what an ordinary fan run to capacity maintains), as the fire gets dirty less air goes through it. Some operators, therefore, in order to keep up the capacity of the set as it gets dirty, increase the pressure under the grate; that is, they try to maintain a constant rate of passage of air through the fire by regulating the pressure under the grate. This constant rate is indicated roughly by maintaining a constant pressure on top of the carburetter, when the carburetter valve is open the regular amount during the blow. Mr. Elbert has spoken of the possible increase in the capacity of a set by reducing the resistance in the set during the

run; that is, by increasing the size of the outlet pipe, or in some other way reducing the resistance between the set and the relief holder. I don't agree with him at all in the importance of this. My own experience would indicate that within ordinary limits the pressure on top of the set makes absolutely no difference in the capacity of the set; it does not appreciably reduce the amount of steam that goes in under the generator per minute and certainly has no effect on the capacity of the fire for decomposing that steam. It may possibly have some little effect on oil efficiency, but even that I never have been able to connect with high pressure on the set.

The President—I have pleasure in extending the thanks of the Association to Mr. Norris for his contribution. We will now take the paper by Mr. Geo. H. Waring on

THE UTILIZATION OF TAR IN A WATER GAS APPARATUS.

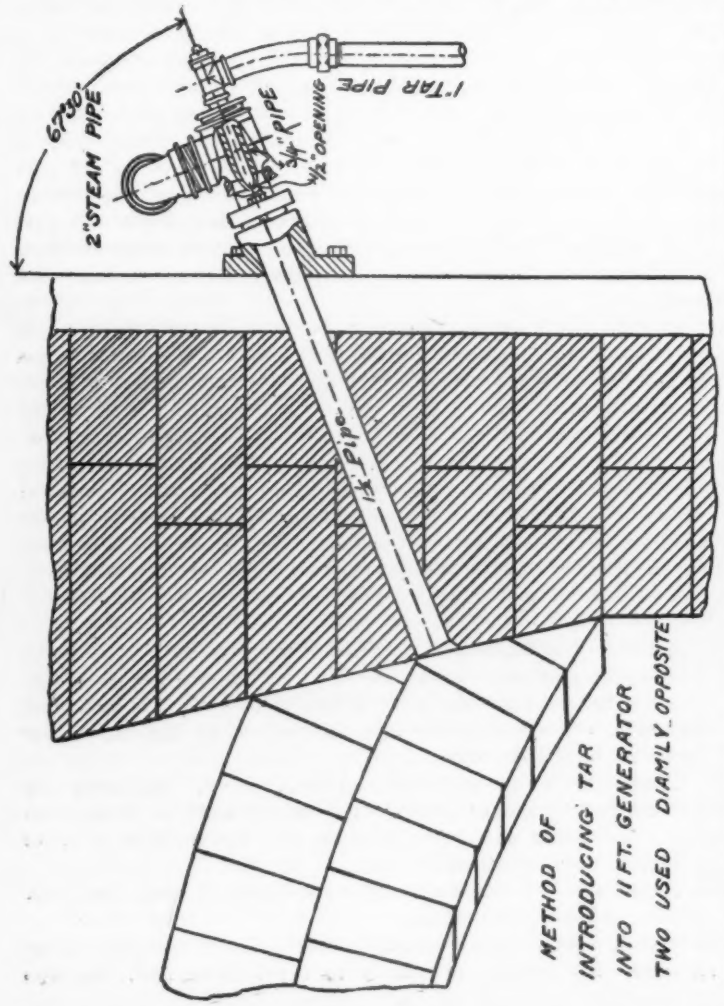
Mr. Waring—Mr. President, I rather anticipated your ruling, and only made a synoposis; did not write a paper.

Oil tar was first used as generator fuel in a double superheater reverse steam Lowe water gas apparatus in 1898 by Mr. I. N. Knapp, then superintendent of the Omaha Gas Company. It was demonstrated to be such a success that its use has been continued in Omaha up to the present time.

The method of utilizing oil tar as generator fuel, as adopted in Omaha, is as follows:

The tar is freed from all but a small precentage of water by passing it through two separators and from thence in a tar well, where it is allowed to stand for some time. The tar to be used in sets is pumped from the bottom of the tar well into the top of the first condenser, where it is stored previous to being used. As the temperature of the gas passing through this condenser is abont 180°, the temperature of the tar is raised to about 130°, and all the remaining water is driven off and hot tar free from water is used.

An analysis of this tar is given below. In the engine room a steam pump, running continuously, draws this tar from the bottom of condenser and maintains a pressure of 30 pounds at the tar meter on generator operating floor. The outlet of the tar meter is connected with two tar nozzles, which are connected into the steam inlets at the top of the 11-foot generator diametrically opposite. The nozzles as shown by sketch are outside of the generator and are subjected to no greater heat than the entering steam. Tar is admitted with steam only on a down run, which is about every third run. The tar is turned on after the steam, and turned off before the steam is shut off. The 1¼-inch induction pipe is kept clear and gives no trouble unless the tar is allowed to leak in. Any leak in the tar valve will cause a deposit of carbon at the end of the 1¼-inch steam pipe. Carbon deposited in the induction pipe can be removed by taking out the 2x¾-inch bushing, carrying the ¾-inch tar nozzle, and inserting an auger of the same design as that used for cleaning standpipes.



The gas maker turns on the tar in generator after turning on the oil in carburetter, and turns off the tar before turning off the oil. After turning off the tar, the tar pipe is blown out with steam which is connected at outlet of tar meter. When using tar on down run smoke will be noted at coal-hole doors, but if these doors are kept tight this smoke is not objectionable. A small amount of lampblack will be noticed in ash pit when an excess of tar is used. The valve stem of the water-cooled hot valve accumulates some pitch, and should be scraped off and oiled about once a day to keep it working freely.

After making a down run when using tar there is quite a showing of smoke at the stack valve when generator blast is put on, but it disappears as soon as the secondary air is admitted. Our gas makers do not object to the use of tar in generators. They now look upon it as upon any other of the necessary functions of gas making. No unusual fouling of fixing chambers and no trouble from naphthaline have been noted, due to the use of tar in generators. Nor does it affect in any way the tar being made.

After using over 1,000,000 gallons of tar in our generators in the past seven years, thereby making a saving of over 4,000 tons of coke, we are able to give the following results as to the value of tar as generator fuel. We have been using tar with more or less success in varying quantities from .3 to 1 gallon per 1,000 cubic feet of carburetted water gas made. Our experience has been that we cannot use over .5 gallon per1,000 efficiently when using oven coke, and .4 gallon when using gas coke, except when making more down runs than every third run. When making fewer down runs than every third run a proportionately less amount should be used. After repeated tests under similar conditions, with and without the use of tar in our generators, we find that the average value of a gallon of tar free from water is equal to 8 pounds of New River or Pocahontas 48-hour oven coke, or 10 pounds of Youghiogheny gas coke. The writer has no data from Omaha as to the value of tar when used with anthracite coal. The following results were obtained from Mr. W. H. Gartley, engineer of works at Philadelphia:

Mr. Gartly found that a gallon of tar was equal to 7 pounds of anthracite coal, and that not over .25 gallon of tar could be used efficiently when using anthracite coal. The data from Philadelphia, like that from Omaha, represents average values taken from results extending over a period of several years. Oil tar has been used as generator fuel with more or less success in Kansas City, Waterbury, Paterson and Yonkers. The writer has no data on this subject except from Omaha and Philadelphia.

As oil efficiencies are so variable under apparently uniforn conditions we have been unable to determine definitely what the enriching value of tar is when used as generator fuel. It has an enriching value from the fact that by its use we are able to obtain better oil results than when no tar is used.

It will be seen from the analyses of samples of water gas taken at the bottom of the generator during a down run, with and without tar, that we have quite an increase in hydrogen, which reduces the percentage of carbonic oxide. Methane is increased by the use of tar. The fixed illuminants are unchanged, but the unfixed illuminants show by analysis an increase of 3 per cent. The chances are that the unfixed illuminants are much higher than shown, as it is impossible to determine accurately these constituents. They are certainly not less than shown, and doubtless much more. The appearance of this gas when burning would corroborate the above; that is to say, that the full amount of illuminants is not shown in the analysis.

The calorific value (calculated from analysis) of these two gases as taken at the base of the generators is as follows: Without tar, 309.16 B.T.U.'s; with tar, 342.20 B.T.U.'s. If taken with the calorimeter it would probably be higher in the case where tar was used. The specific gravity of these gases at 60° F. air = 1, as calculated from the analyses, is as follows: Without tar, .554; with tar, .456.

The average make per run, including all runs, is increased about 4 per cent. by the use of tar. The saving in labor and boiler fuel by the use of tar is so small that it would not be worth considering.

As we make about .70 gallons of tar per 1,000 cubic feet of carburetted water gas, the importance of disposing of our tar to the best

advantage should be emphasized, and while we cannot utilize all of our tar in our generators, it will be seen that we can use from one-third to two-thirds of our total make in this way, leaving the remainder to be disposed of in other ways.

If we utilize half of our tar in our generators, we should be able to dispose of the other half at a better price per gallon than we could obtain by selling all of our tar.

We must appreciate the value of our own product, if we want others to, and we must be able to utilize this product to advantage when we are unable to sell it at a fair price.

Other papers show ways of utilizing tar besides that of generator fuel, therefore it is not necessary for us to sell any of our tar. We can dispose of all we make in our own plant.

The uses to which oil tar can be put are so numerous that the writer does not hesitate to predict that the day is not far distant when a gallon of oil tar will purchase a gallon of gas oil.

Analyses of Uncarburetted Water Gas from Omaha, Neb.

	Without Tar in Generator.	With Tar in Generator.
Benzine vapor, C_6H_6	0.0	.3
Carbonic acid, CO_2	6.8	7.5
Illuminants	.5	.4
Carbonic oxide, CO	39.2	23.3
Oxygen, O_2	.5	.6
Hydrogen, H_2	50.0	60.4
Ethane, C_2H_6	0.0	.4
Methane, CH_4	.8	4.2
Nitrogen, N_2	2.2	2.9
	100.0	100.0
B.T.U.'s per cubic foot	309.16	342.20
Specific gravity air = 1	.554	.456

The above samples were taken between fifth and sixth minute of an 8-minute run, hence high carbonic acid.

Analysis of Uncarburetted Water Gas from Philadelphia, Pa.

	Without Tar in Generator.
Benzine vapor, C_6H_6	0.0
Carbonic acid, CO_2	3.0
Illuminants	0.0
Carbonic oxide, CO	42.8
Oxygen, O_2	.4
Hydrogen, H_2	50.2
Ethane, C_2H_6	0.0
Methane, CH_4	.4
Nitrogen, N_2	3.2
	100.0

The above sample was taken during whole run, showing the average composition of "blue gas" without tar in generator.

Analysis of Oil Tar from Omaha, Neb.

Sample of tar used in generator, 9-29-03.
Specific gravity, 1.1602.
Water, none.

Distillation Test.

Crude Products of Distillation.	Per Cent. by Volume.	Per Cent. by Weight.	Sp. Gr.	Fractions.
Light oils (below 338° F.)	8.3	6.12	.8733	Canary.
Middle oils (338°-518° F.)	41.3	35.41	.9948	Ch. Yel.
Anthracene oils (ab. 518° F.)	30.5	28.87	1.1018	Dk. Red.
Residuum	....	28.96	....	.....
Total	80.1	99.36	....	.....

Note absence of water.

Discussion.

The President—You have heard the presentation of Mr. Waring's paper. It is open for discussion.

Mr. Dewey—Mr. Waring has confined his paper entirely to the use of water gas tar. Several plants have experimented with coal tar in gas making and used same with moderate success. In a paper read by Mr. Henry Lea, before the meeting of the Ohio Gas Association in 1904, a very full account was given of the method and results obtained in Detroit by the use of water gas tar in gas making. The results obtained in Detroit were considerably different than those obtained in Omaha, the reason for this being that while Omaha aims to supplant coke, we aim to supplant oil. We found that a gallon of tar was equal in every respect to a gallon of oil. No particular difficulty was observed in its use, slightly more carbon was formed, but not in sufficient quantities to make same serious. The first method used was the injecting of the tar into the side of the generator above the fuel bed, with an enlarged Western gas oil spray. After 3 months' operation we noticed that the lining of the generator on the opposite side from the tar spray was being disintegrated. We then changed our methods by introducing the tar through the lid of the generator by means of a Johnson rotary oil spray. The holes in the cap and the nozzles of the spray being enlarged, some trouble was experienced from the carbonization of the spray. We then designed a special spray, which introduced the tar through the generator lid. The spray was a metal disk attached to a ¾-inch gas pipe. Just above the upper parts of the disk small holes were bored in the ¾-inch pipe to allow steam to impinge on the surface of the disk. Incasing the ¾-inch pipe was a 1¼-inch pipe. This pipe terminated about ½ inch above the disk; the tar was forced through the 1¼-inch pipe. The spray was lifted out of the generator during the blast. The object of the spray was to spray the tar in a fine mist around the outer edge of the coke bed. We found that the placing of any considerable amount of tar at the center of the coke bed caused caking of the coke. Tar was introduced during the up runs only. We found as high as 20 per cent. of the total enricher could be tar, with excellent results. Mr. Waring finds by his method that tar is equal to 10 pounds of coke. In Detroit this would make tar worth 1½ cents per gallon as generator fuel. By our method tar is made equal in value to one gallon of gas oil. I believe that Mr. Waring could use larger quantities of tar if he adopted a spray that would throw the greater portion of the tar to the outside of the fuel gas. From the drawings attached to the paper, I should judge that a great percentage of the tar was deposited at the center of the fuel bed.

The President.—Is there any further discussion?

Mr. Leonard Fitzgerald—I want to ask Mr. Waring if he has experimented with a smaller machine than he is at present using, and if it had an up and down run arrangement. A couple years ago I tried to use tar in a 5-foot machine making up runs only, but my experiments were unsuccessful. We injected tar on top of the fuel bed during the run, but about the only result we obtained was the undesirable one of carbonizing our checkerbrick.

Mr. Macbeth.—Mr. Waring found that he could not put much oil tar on top of his generator fire when he was using retort house coke. We found in Kansas City we could put in more oil tar when using retort house coke than with any other fuels but that may be explained from the fact that we used hot retort house coke without quenching it at all. I think the trouble in most plants using tar is with the smoke at the generator doors. I know of more than one plant where they stopped on account of smoke. Personally I think that most of the trouble has been along that line, but this smoke can be done away with, there is no question about it. Mr. Waring emphasized the fact that his tar has no water. I think that tar with quite a large precentage of water can be used in a generator without any noticeable evil results. If we take an 8½-foot set, which is making 6,000 for a run, and inject on every third or down run 10 gallons of what is supposed to be tar, but containing one gallon of water, or 10 per cent., if figured out theoretically it would not increase our generator fuel over $\frac{1}{25}$ of a pound on the total make of the machine, and therefore there would not be any appreciable increase in the amount of coke used to evaporate that gallon of water. It might, however, throw the adjustment of the machine out somewhat, as it would increase the amount of steam admitted on that run about 4 per cent.

Mr. Elbert—Any water that would go in with the tar introduced at the top of the generators would furnish steam, and that steam will pass along, and if there is any carbon on the bricks of the superheater it will pick it up and take it along with it, making water gas. I don't see any danger from that whatever. There is one thing that ought to be considered in using up water tar. We certainly cannot use all our coal tar for this purpose. With the tar produced from regenerative furnaces you cannot furnish it to the tar paper factories (who seem to be the principal buyers) without some water tar. They have to have from 40 to 50 per cent. of water tar to dilute the coal tar, or they won't buy the coal tar. Now, to use up all your oil tar, you have got to use up the coal tar.

Mr. Macbeth—I think the last gentleman who spoke—I don't know his name—misunderstood what I said. This gallon of water has got to go down through the generator fire. It goes in with the tar on top of the fire and goes down, and, therefore, the carbon on the carburetter brick does not have any effect.

Mr. Elbert—On the up run it would have an effect. On the up run it would not go through the generator; it would have to go through simply the carburetter and the superheater, and would have an effect on the carbon on the superheater brick.

The President—Is there any further discussion? If not, I will ask Mr. Waring to close the discussion.

Mr. Waring—Mr. Dewey brought out the point of using oil tar as an enricher. My paper was entirely as a generator fuel. He says

that in his experiments, which were brought out by Mr. Lea's paper, 1 gallon of tar had the enriching value of 1 gallon of gas oil. I would like to go on record in taking exception to this statement, and I think the analysis of oil and oil tar will bear me out in this. Extensive experiments have been made in regard to gasifying thoroughly oil tar and gas oil. I don't think the results have shown more than half value for the ordinary oil tar as compared with gas oil. As to Mr. Dewey's criticism on the improvement of the tar spray, I think it can be very much improved upon. The tar spray is very simple, but it has answered the purpose and has given us great satisfaction. We have used it for about 7 years and gotten very good results. Mr. Fitzgerald asked a question as to the utilization of tar in a base steam generator. We have not made any tests with that. I don't see how it is possible to use tar in a base steam generator, because you cannot make a down run with a base steam generator, and you cannot use tar for generator fuel unless you use it on a down run. You can utilize it as an enricher on an up run, but you cannot use it as generator fuel except on a down run. The construction of the condenser is merely incidental to this experiment, to show how we got the water out of our tar. We simply used tar in the first condenser, an open head condenser, in the place of water. Mr. Macbeth says that he found that he could use more tar with oven coke than he could with gas coke. My statement was that the efficiencies necessitated the reduction of tar with——

Mr. Macbeth—Mr. Waring, you are mistaken there.

Mr. Waring—You said that you could use more tar with oven coke.

Mr. Macbeth—With retort house coke.

Mr. Waring—And I claimed that you could use more with gas house coke.

The President—That is the same thing.

Mr. Waring—My paper shows that I used 4-tenths of a gallon of tar with gas house coke, and not exceeding 5-tenths with oven coke. You take the opposite stand, but you don't say in regard to efficiencies. You said that you could use more tar. Do you know that to be the fact as to efficiencies?

Mr. Macbeth—Yes. More efficiently.

Mr. Waring—I would like to ask Mr. Macbeth if he can give us some figures in regard to this, what efficiency he did find, because we want other figures than those of Omaha. If we could get Kansas City's figures in regard to this it would be very interesting. Mr. Macbeth, have you any figures?

Mr. Macbeth—Our results show about the same as yours; about 1 gallon of oil tar equal to 8 pounds of fuel.

Mr. Waring—The reason the point was brought out as to the amount of water, that our tar was free from water, was that we wanted to show that the results were gotten with pure tar, that the gallon was tar and not tar and water, as the majority of water gas tar or oil tar has a high percentage of water in it. That is the reason why we were particularly anxious to eliminate the water.

The President—I have pleasure in extending the thanks of the Association to you, Mr. Waring. The Secretary has a few more letters and telegrams of regret.

The Secretary—We have a telegram from I. C. Copley.

Mr. Paul Doty, President, Western Gas Association, Cleveland—I wish for you and the Association the most successful meeting in its history, and regret very much that I cannot meet with you.

We also have a letter of regret from Mr. Donald McDonald, President of the Kentucky Heating Company.

The President—On behalf of the local Committee of Arrangements I desire to extend to you an invitation to be present to-night at Dr. Tolman's lecture, and it is hoped that you will come in large numbers. Also on behalf of the committee I desire to state that after the lecture there will be a form of entertainment, a buffet lunch and smoker, and I presume the lunch and smoker will be in this room. I believe the lecture is to be given in this room. The lecture will be at 8 o'clock, and the luncheon after the lecture. If there is no further business, I will now declare the afternoon session.

Mr. Gimper—Mr. President, I rise to a point of inquiry. This morning we received the report from the Board of Directors, and in that report there is a statement made, at the end of it, empowering the committee to dissolve this Association. Is it done? Are we no longer the Western Association?

The President—Yes, sir, we are still the Gas Association, and we are doing business as the Western Gas Association yet.

Mr. Gimper—Are we now to act upon that, before we leave here, about abandoning our Association and amalgamating or joining another one?

The President—That has been referred to a committee to be appointed by the President, with full power to act.

Mr. Gimper—And that committee will dissolve us and vote us into another association?

The President—I presume those are the instructions of the Association.

Mr. Gimper—I would prefer, then, to make a motion to reconsider that part of the report. I do not feel like I want to delegate my going out of this Association to a committee. I would like to vote upon it myself.

The President—You voted on it this morning, Mr. Gimper.

Mr. Gimper—We voted on it? I did not understand that. Then we are out of the Association. If the committee have the power to say that we do belong or shall belong to another association, then we are not the Western Association now. I don't know that I am a member now of the Western Gas Association. We are doing business, and I don't know whether you are its President. If the committee has done that, then we are no longer the Western Gas Association.

The President—The committee has not done it.

Mr. Gimper—When do they do it?

The President—I cannot say that. The committee of organization, representing the Western Gas Association, will probably meet at an early day with similar committees representing the other associations.

Mr. Gimper—I have no objection at all to making one association out of the three, only I object to the manner in which it is being done. I would like to vote upon that matter. There is a report of the Board of Directors, but I thaught it ought to be brought before the whole Association, and that the Association vote should be taken on that subject.

The President—That was done this morning, Mr. Gimper.

Mr. Gimper—Well, I move that we reconsider that part of the report.

The President—Your motion con be made and entered on the record, but consideration of the motion I would rule now out of order. It is not in the order of the day. You will be given a chance, Mr. Gimper, under the order of miscellaneous business or new business, as provided under the constitution, if you desire, to bring that point up, but at this present moment I should rule it out of order. If there is no further business I will now declare the meeting adjourned to meet this evening at 8 o'clock.

First Day—Evening Session.

The Association reassembled at 8:20 P.M.

The President—Ladies and gentlemen, I have the pleasure of presenting to you to-night Dr. William H. Tolman, of New York, who will deliver to you an address upon the subject of Industrial Betterment. Dr. Tolman is Director of the American Institute of Social Service, and those who have followed his work know that it needs no word of mine to commend what he may say to you to-night. Those of you who were present at the Gas Congress in St. Louis in 1904 will remember that a paper was presented by Mr. Frederick H. Shelton upon the labor problem. I believe that was the first time that the labor problem was prominently presented to your notice. There was a great deal of interest manifested in Mr. Shelton's paper, and in the discussion which followed it was brought out that many of the gas companies throughout the United States were following in some way some of the work of industrial improvement or industrial betterment. For example, some of the companies have established profit sharing, whereby the employees of the company were paid a dividend upon the amount of wages earned yearly at the same rate that the stockholders were paid upon their investment or upon their holdings of stock. Many of the other companies had done other work, such as more sanitary conveniences, lockers, wash-rooms, recreation classes, etc., but we were really groping; we did not know what to do. The spirit was willing, but the flesh was weak. In other words, we did not have at that time a knowledge of the work which was being carried out by the Institute of Social Service, which Dr. Tolman represents. So that I feel we have a unique opportunity, if only we can absorb all of the good that Dr. Tolman is going to tell us about, to take back and put it into practice in our own words, and if something of that kind is done I feel that the Doctor's mission here to-night will have been accomplished, and I feel that it will add to the credit of the Association. Therefore I invite your cordial attention to Dr. Tolman's address. Dr. Tolman, the Western Gas Association.

Dr. William H. Tolman then delivered a lecture on "Industrial Betterment," illustrating it with a large number of stereopticon views.

Second Day—Morning Session.

The Association reassembled at 10:2 A.M.

The President.—The first order of business this morning will be the presentation of the paper by Mr. W. E. Hartman,

NOTES ON CARBONIZATION.

Probably no branch of the gas industry offers a more fertile field for research than the process of carbonization. A search through our technical literature shows that very little has been learned of the thermo-chemical changes which the coal and the gas undergo in the retort. It is generally admitted that at high carbonizing temperatures the gas is overheated. Accordingly some advocate low heats, being satisfied with relatively low gas yields and avoiding excessive production of lampblack and naphthaline. Others advocate high heats with high gas yields, and have various special methods to overcome inconvenience from the lampblack and naphthaline produced. The following experiments were undertaken with a view to learning something of the relative composition and calorific value of coal gas produced under different specified conditions.

The retorts used were 16 inches by 28 inches by 9 feet in a full depth setting of 6. The coal was Pennsylvania gas coal of uniform size throughout the tests. The charging was by hand. The heats on the setting were regulated to thoroughly carbonize the charge in the 4 hours in each case, the yield of gas being from 5 to 5.05 cubic feet per pound of coal. The analyses were made from 3 gas samples from each charge; 1, ½ hour after charging; 1, 2 hours after charging, and

TABLE I.—*Showing Influence of Size of Charge upon the Quality of Gas.*

Size of Charge.	Time of Sampling.	CO_2 and H_2S	C_2H_4	O	CO	H	CH_4	N	B.T.U. per Cubic Feet.	Maxim. Temp. of Gas 11 Feet Above M. P.
300 pounds.	½ hour after charging	3.0	6.8	.3	8.0	38.4	41.6	1.9		
	2 hours " "	1.0	.8	.1	6.8	55.0	27.9	8.4		428° F.
	½ hour before drawing	.6	.2	.0	7.5	70.6	10.3	10.8		
	Average	1.5	2.6	.1	7.4	54.7	26.6	7.1	543	
400 pounds.	½ hour after charging	3 1	8.2	.8	7.2	34.8	45.2	.7		
	2 hours " "	2.3	3.5	.2	7.1	49.3	31.1	6.5		522° F.
	½ hour before drawing	.0	.2	.1	5.6	78.7	8.4	7.0		
	Average	1.8	4.0	.4	6.6	54.3	28.2	4.7	579	
500 pounds.	½ hour after charging	2.6	8.1	.4	7.3	35.0	44.6	2.0		
	2 hours " "	2.6	3.0	.0	6.3	45 8	34.8	7.5		504° F.
	½ hour before drawing	1.4	.4	.1	6.1	60.8	24.4	6.8		
	Average	2.2	3.8	.2	6.6	47.2	34.6	5.4	620	

TABLE II.—*Showing Influence of Length of Retort Upon the Quality of Gas.*

Length of Retort.	Size of Charge	Time of Sampling.	CO_2 and H_2S	C_2H_4	O	CO	H	CH_4	N	B.T.U. per Cubic Feet.	Maxim. Temp. of Gas 11 feet Above M. P.
9 feet.	400 pounds.	½ hour after charging	3.1	8.2	.8	7.2	34.8	45.2	.7		
		2 hours " "	2.3	3.5	.2	7.1	49.3	31.1	6.5		522° F.
		½ hour before drawing	.0	.2	.1	5.6	78.7	8.4	7.0		
		Average	1.8	4.0	.4	6.6	54.3	28.2	4.7	579	
4½ feet.	200 pounds.	½ hour after charging	2.5	7.4	.0	7.3	39.6	41.8	1.4		
		2 hours " "	2.2	3.5	.1	6.5	46.0	35.7	6.0		220° F.
		½ hour before drawing	.0	.2	.0	4.5	70.9	20.1	4.3		
		Average	1.6	3.7	.0	6.1	52.2	32.9	3.5	615	

TABLE III.—*Results Obtained in Detroit in* 1899.

21 feet.	No data.	½ hour after charging	2.6	3.0	.7	7.3	22.1	57.3	7.0		
		2½ hours " "	.8	.2	.0	3.7	62.8	28.9	3.6		790° F.
		3½ hours " "	.0	.0	.0	2.8	77.0	15.4	4.8		
		Average	1.1	1.0	.2	4.6	54.0	33.9	5.1	583	
10 feet.	One-half as much as in 21-foot retort.	½ hour after charging	2.7	4.9	.2	5.7	26.6	55.0	4.9		
		1½ hours " "	1.1	2.2	.1	3.7	48.8	39 0	5.1		466° F.
		3½ hours " "	.4	.7	.0	2.5	61.6	27.1	7.7		
		Average	1.4	2.6	.1	4.0	45.7	40.4	5.8	648	

TABLE IV.—*Showing the Effect of Thickening the Top Wall of the Retort.*
This was accomplished by laying a row of tile 2 inches thick and 12 inches wide along the top of the retort.

Top Wall of Retort.	Size of Charge.	Time of Sampling.	CO_2 and H_2S.	C_2H_4.	O.	CO.	H.	CH_4.	N.	B.T.U. per Cubic Ft.	Max. Temp. of Gas 11 Ft. above M.P.
Ordinary	300 pounds.	½ hour after charging	3.0	6.8	.3	8.0	38.4	41.6	1.9		
		2 hours "	1.0	.8	.1	6.8	55.0	27.9	8.4		
		½ hour before drawing	.6	.2	.0	7.5	70.6	10 3	10.8		428° F.
		Average	1.5	2.6	.1	7.4	54.7	26.6	7.1	543	
2-inch tile on top	300 pounds.	½ hour after charging	2.8	8.7	.2	6.5	30.9	49.9	1.0		
		2 hours "	1.4	3.9	.3	5.9	46.4	33.4	8.7		
		½ hour before drawing	.2	.2	.1	3.8	72.7	13.5	9.5		
		Average	1.5	4.3	.2	5.4	50.0	32.3	6.3	609	
Ordinary	400 pounds.	½ hour after charging	3.1	8.2	.8	7.2	34.8	45.2	.7		
		2 hours "	2.3	3.5	.2	7.1	49.3	31.1	6.5		
		½ hour before drawing	.0	.2	.1	5.6	78.7	8.4	7.0		522° F.
		Average	1.8	4.0	.4	6.6	54.3	28.2	4.7	579	
2-inch tile on top	400 pounds.	½ hour after charging	2.3	7.2	.0	7.4	35.0	42.8	5.3		
		2 hours "	1.3	3.1	.0	6.8	48.3	34.4	6.1		
		½ hour before drawing	.0	.4	.0	5.0	62.7	22.8	9.1		422° F.
		Average	1.2	3.6	.0	6.4	48.7	33.3	6.8	607	

TABLE V.—*Showing Effect of Additional Thickening of Top Wall of Retort.*

The row of tile previously placed on top of the retort was covered with a 3-inch layer of fireclay and mineral wool.

Top Wall of Retort.	Size of Charge.	Time of Sampling.	CO_2 and H_2S.	C_2H_4.	O.	CO.	H.	CH_4.	N.	B.T.U. per Cubic Ft.	Max. Temp. of gas in pipe, 11 Ft. above M.P.
Ordinary	300 pounds.	½ hour after charging....	3.0	6.8	.3	8.0	38.4	41.6	1.9		
		2 hours "	1.0	.8	.1	6.8	55.0	27 9	8.4		
		½ hour before drawing...	.6	.2	.0	7.5	70.6	10.3	10.8		428° F.
		Average.....	1.5	2.6	.1	7.4	54.7	26.6	7.1	543	
2 inches of tile and 3 inches of fireclay and mineral wool.	300 pounds.	½ hour after charging....	3.0	9.3	.2	6.1	28.4	53.0	.0		
		2 hours " ...	2.1	3.3	.1	5.3	47.6	35.7	5.9		
		½ hour before drawing...	.0	.1	.3	1.3	76 0	11.4	10.9		3 0° F.
		Average	1.7	4.2	.2	4 2	50.7	33.4	5.6	617	
Ordinary	400 pounds.	½ hour after charging....	3.1	8.2	.8	7.2	34 8	45.2	.7		
		2 hours "	2.3	3.5	.2	7.1	49.3	31.1	6.5		
		½ hour before drawing...	.0	.2	.1	5.6	78.7	8.4	7.0		522° F.
		Average.....	1.8	4.0	.4	6.6	54.3	28.2	4.7	579	
2 inches of tile and 3 inches of fireclay and mineral wool.	400 pounds.	½ hour after charging....	2.2	8.6	.3	6.3	30.9	51.3	.4		
		2 hours "	1.8	4.5	.2	6.5	45.8	36.8	4.4		
		½ hour before drawing...	.1	.8	.0	4.7	62.9	22.7	8.8		396° F.
		Average.....	1.4	4.6	.2	5.8	46.5	36.9	4.6	653	
Ordinary	500 pounds.	½ hour after charging....	2.6	8.1	.4	7.3	35.0	44.6	2.0		
		2 hours "	2.6	3.0	.0	6.3	45.8	34.8	7.5		
		½ hour before drawing...	1.4	.4	.1	6.1	60.8	24.4	6.8		504° F.
		Average.....	2.2	3.8	.2	6.6	47.2	34.6	5.4	620	
2 inches of tile and 3 inches of fireclay and mineral wool.	500 pounds.	½ hour after charging....	3.4	8.2	.2	7.0	35.7	45.5	.0		
		2 hours "	2.3	5 0	.3	6.8	42 3	39.3	4.0		
		½ hour before drawing...	.7	2.3	.7	5.7	51.8	31.5	7.3		428° F.
		Average.....	2.1	5.2	.4	6.5	43.3	38.8	3.7	675	

1, ½ hour before drawing. Several check analyses were made in each case and the results averaged. The point of sampling was on the standpipe, 2½ feet above the mouthpiece. The temperature of the gas was noted throughout each charge, at a point in the standpipe 11 feet above the mouthpiece. The heat units were calculated from the analyses, assuming the illuminants as ethylene and using the following values for the B.T.U.'s per cubic foot: Ethylene, 1,681; carbon monoxide, 343; hydrogen, 344, and methane, 1,072.

The first series of experiments show the influence of the size of the charge upon the quality of the gas. The second series shows the influence of length of retort upon the quality of the gas. In this connection is given a table showing comparative analyses and calorific values of gas made in 21-foot retort and in a 10-foot retort. These analyses were made in Detroit in 1899 and under different conditions from those given in the other tables; but they also show the inferiority of gas made in long retorts.[1] The third and the fourth series show the effect of insulating the top wall of the retort, making this part less conductive of heat and thereby protecting the hydrocarbons in the gas from decomposition.

These results would seem to indicate that the present pattern of retort is not adapted for making gas of the best quality when carbonization is carried on at high temperatures. Evidently the upper part of the retort becomes too hot for good results. More heat enters the retort through its upper wall than is needed to properly fix the gas. Consequently the hydrocarbons suffer decomposition and lampblack and naphthaline are formed. Conditions seem to demand a high carbonizing temperature in the lower part af the retort, and a lower temperature, merely a fixing temperature, in the upper part. It has been shown that the difficulty is seriously aggravated by the use of long retorts, and is only partially overcome by heavy charging. The foregoing experiments would show that a remedy lies in the proper insulation of the upper wall of the retort.

Discussion.

The President—You have heard the reading of Mr. Hartman's paper. It is open for discussion. I will ask the Secretary to read a contribution from Mr. John R. Lynn.

Mr. John R. Lynn (read by the Secretary)—The paper by Mr. Hartman presents an interesting subject—one neither hashed nor rehashed in the past, and the points are clearly and concisely given. That the amount of coal charged per retort has material effect upon not only the quality, but also upon the quantity of gas produced, is a proposition, entitled by age to respect without discussion. Referring to Table II., 4½-foot retorts are purely experimental and of no practical value in the production of gas as a commercial commodity. Such construction necessarily involves radiant loss and consequent increased fuel consumption to an extent that prohibits its adoption. The data in Table III., was originally prepared to illustrate the advantage (more imaginery than real) gained by converting a through retort of 21 feet in length into two 10-foot retorts. For comparative purposes a larger quantity of coal should have been charged into the through retort than into the two shorter ones, since by the construction of the division wall the best 12 inches of the retort was put out of commission and at least 7½ per cent. of its efficiency eliminated. Furthermore, as the through retorts at the Detroit works were provided with separate mouthpieces, standpipes, etc., at each end, they were to all practical purposes 10½-foot retorts and the comparison made does not really apply. Seals aud other conditions being the same one-half the gas produced passed each way and but a small proportion travelled from 1 to 6 inches further than in the 10-foot retort. During my connection with the Detroit Gas Company these retorts made good gas, plenty of it, and we had no trouble, which we were not able to care for at any time. Tables IV. and V., illustrating the effect of thickening the top of the retort present interesting figures but it is not demonstrated that the cost of making such a change is justified by results. Taking the data throughout, the variations are striking and it is likely that experiments covering a longer continuous period along these same lines would, if carefully and accurately tabulated, present variations even more striking and more unaccountable. There is no piece of mechanism about the gas works that presents so much individuality as a bench. Two benches of the same design, erected by the same workmen, each the prototype of the other and standing side by side in the same building, frequently disclose different characteristics in the results of operation. Why is this? The wise man, who can reply, should reap a rich reward. Mr. Hartman's effort should lead to others along this line, for the subject of carbonization contains many unsolved problems. It will be found uniquely rich in that respect.

The President.—Is there any further discussion on Mr. Hartman's paper?

Mr. Egner.—Mr. President, I should like to say a few words on that. I want to call attention to the fact that at one of the general meetings of the German Gas and Water Engineer's Association, one of the members, Herr Hilgenstock, read a paper on carbonization of coal with special reference however to the process in by-product coke ovens; in the course of which he describes what is going on inside of the retort in the course of the operation. I think it would be well if Mr. Hartman, or anyone interested in the subject, woald look up Herr Hilgenstock's paper, which was published in the proceedings of the Association named, in the German Gas Journal, and some portions afterwards a-

1. "Pitch in Hydraulic Mains." B. O. Tippy, AMERICAN GAS LIGHT JOURNAL, March 20, 1899.

stracted by myself and published in the AMERICAN GAS LIGHT JOURNAL, though I cannot now recall the date. It seems to me, that in Mr. Hartman's paper altogether too much is taken on assumption, which might be eliminated in a future paper if Mr. Hartman can be induced to give us one on the same subject, as I hope he will. Now, about a through retort giving poorer results than one that is not a through retort, I cannot see any good reason for that provided, the standpipes of the same are open at both ends, or even if but one of them is clear. There are several things that I wished to say upon the subject, especially concerning the results claimed to be obtained by carbonizing coal in the "standing" retorts; but, let it go at this time, because I suppose others want to speak on this subject also.

The President—Is there any further discussion? Mr. Hartman, will you close the discussion?

Mr. Hartman—The experiments noted in Table No. 3 were obtained in Detroit in 1899 with retorts 21 feet long. Those retorts had 2 stand pipes, one at each end, but practically 2 standpipes proved no better than 1. The retort house conditions were such that it was a very difficult matter to have the 2 standpipes equally clear, or if they are clear it is difficult to have the seals in the hydraulic mains on the 2 sides equal. In practical running conditions it was found that most of the gas traveled one way. For that reason the through retort with 1 standpipe in Detroit at that time would have been as good as the retort with 2 pipes. Mr. Lynn states that good gas was made in Detroit while he was there. I don't know anything about that, but I know that the conditions were very unsatisfactory with the through retorts at the time these experiments were made, and as a result the retorts were bricked up in the center and run as 10-foot retorts. It saved considerable labor on the hydraulic mains. It made better gas and better tar. The change was beneficial in every way. The paper is intended merely to summarize some experiments. It is experimental work, and it not claimed that these results are conclusive. The results are conclusive for the conditions under which they were worked.

The President—I extend the thanks of the Association to you, Mr. Hartman. The next order of business is the paper of Mr. Fred. Bredel on

FIRING OF RETORT BENCHES BY BATTERY PRODUCERS.

Mr. President and Gentlemen of the Association: Through the kindness of our President I was invited to write a paper on "Isolated Bench Firing." As you know, on a former occasion I was one of a committee on the same subject; one of the members of this committee entirely misunderstood the meaning of the subject and imagined this was a question of heating benches with an outside generator, as formerly was done in the so-called Munich and Hasse Didier bench, which I had condemned long ago for very good reasons, and which have been abandoned now also by the builders, and they are adopting the inside generators. I think it is, therefore, advisable that we come to an understanding of what is meant by the term "isolated bench firing." I have taken the liberty of coining a new phrase and calling it "firing of retort benches by battery producer." I do not blame our friend, the member of the former committee, in making the mistake and thinking it meant detached generator (for inetance, as the old Munich bench), as "isolated" means "standing detached from others of a like kind; placed by itself alone," and that would mean that each bench had its own generator, but away from the bench. I hope, therefore, that in the future my denomination will be accepted so as to prevent further misunderstanding and unnecessary discussions such as has taken place at different times in informal discussions when the expressions "generator," "regenerator" and "recuperative benches" were kind of vague and continuously misunderstood, the same as it now is with "half depth" benches, which might mean almost anything.

In considering the advantages and disadvantages of benches fired by battery producers, we must first consider what we are driving at and where we expect to make our gain.

First of all, let it be understood that producer fired benches would be of no avail to small gas works, as the cost of erecting the producer, pipe line, valves, etc., belonging to the producer would far overbalance any advantage to be gained. This seems to be so clear that there is no use discussing this point. We will, therefore, immediately take up the question of larger gas works. By this I mean gas works with a generating capacity of at least 500,000 feet and over per diem.

To compare the advantages and disadvantages we have to compare it with an installation of recuperative benches that are recuperative benches in the fullest sense, and that cost of installation for one be the same as for the other. For a larger producing capacity, as a million feet or over per diem, we naturally have to compare it with benches of nines or twelves; benches of sixes and vertical eights, on account of their large cost of installation per 1,000 feet capacity, we will leave out of our consideration, as gas works which can afford battery producers can afford benches of nines, and if they can afford vertical eights, which require charging and drawing machines, they can use twelves to better advantage.

The question now is: "What is to be gained with a battery producer."

1. There need be no opening of the filling and clinkering doors, and this will give a gain of 5 per cent. in the efficiency.

2. The amount of gas entering the bench can be adjusted to a nicety and the heat regulated very easily, providing intelligent men handle it, giving another gain of say 5 per cent.

Disadvantages.—1. The fuel has to be fired into the producer cold; the loss is from 10 to 15 per cent. of the fuel used. It might be said that the coke could be brought to the producer hot by means of conveyor, but we will leave this out of the question, as the cost of installation and maintenance would be more than would be gained thereby.

2. The fuel gases coming from the producer have to be cooled and carried in such a way that they will not attack the valves; that means another loss of heat of about 10 per cent. fuel value. Theoretically this could be regained by running the producer with a large amount of steam and making hydrogen gases. This necessitates an enormous combustion chamber on account of the large expansive power of water vapor, and, as such producers cannot be run excepting with an excess of water vapor, there is again a large loss. Besides that, the initial flame temperature will be much lower than if a high percentage of CO gases and low percentage of hydrogen are the component parts of the producer gas, while the generator directly under the bench setting can be run with a minimum of water vapor, just sufficient to prevent clinkering.

As regards to data of amount of heat lost or gained, I would refer you to paper entitled "The Advantages of Recuperative Furnaces in the Utilization of Heat," which I prepared for the meeting of the Western Gas Association at Detroit in 1892.

ADVANTAGES AND DISADVANTAGES OF SEPARATE GENERATOR FOR EACH BENCH.

Disadvantages.—1. First of all, we have the loss of heat by opening the filling and clinkering doors. The loss of heat by opening the filling door will not amount to 5 per cent. of total fuel value, and sometimes less, if the benches have the right kind of recuperator and the benches are constructed properly. Naturally, if the benches are so designed as to practically need a stack like a steam boiler to get sufficient draught to carry the waste gases away, then the loss becomes higher, as air will enter with a rush, but if benches will work under a low draught, practically under plus minus, this loss is very little. A throttling, therefore, of the products of combustion or waste gases at any place must not occur; and parallel flues for waste gases are to be condemned on account of tremendous friction caused thereby, which means power, and power means fuel.

2. *Clinkering the Generator.*—This, when carefully handled and with good coke, is not necessary more than once in four or five days, and a gas works of the sizes mentioned can just as well have a man to attend to the furnaces as where there is a battery producer, and the loss incurred thereby when the fires are handled carefully will not amount to more than at a maximum of 2 or 3 per cent. more than with battery producers. This loss is so small that it can be neglected in the calculation.

Now comes the most important part. In a bench fired with its own producer the heat will go up and down with the state of the fuel in the generator. When the fuel bed is at its lowest point and full of clinkers, and when it produces the most carbonic acid, and therefore the least amount of generator gases, then the secondary air will pull the most and cool off the bench. Tihis naturrally only applies where there is gross carelessness in clinkering and where the generator is allowed to get full of clinkers or is bridged over. If we would handle producers the same way as we sometimes try to handle our generators the same thing would happen, and then we would have no end of trouble..

The other varation by high and low fuel beds are partly overcome by the heat storage capacity of the recuperator. A recuperator that does not have sufficient surface and at the same time, *and most important*, sufficient bulk, is of no more use than the same kind of construction in water gas superheaters. Most coal gas men to-day do not care what kind of a recuperator they get, what is its heating surface and heating ratio (or, in other words, its recuperative efficiency), nor what its weight, respectively, its accumulate efficiency is, nor what its cubic

contents of both air and gas is, which latter means efficiency. The same gas man, if anyone would propose a water gas superheater to him, only fit for a 4-foot set to be installed in combination with an 8-foot set, would immediately condemn the practice, and yet many will pay no attention whatever to the recuperator. Anything seems to be good enough as long as it heats the air; never mind at what cost.

To overcome the continuous change in the bench fired by its own generator, I have advocated and designed benches with twin generators. I put two generators side by side under the same bench, and they must be alternately fired, and connected on top so that the gases of the two mingle, and gases of the same chemical composition are constantly produced; then when the generators are charged and clinkered alternately, that is to say, for instance, if we fire every four hours, the one generator should be filled say at 12 and 4 o'clock and the other at 2 and 6 o'clock, and if we clinker each generator every four days, one of them should be clinker on the 1st and 5th and the other on the 2nd and 6th days, so that the same one would be clinkered every four days. By this arrangement we get the same advantage that the battery producer gives.

It is of course understood, in talking of battery producer, that two producers are always in operation, when one has a high fuel bed the other is low, as one single battery producer would be of no earthly good.

Another seeming disadvantage is that it will cost more labor to attend to so many generators instead of two producers, but this is not so, as the cost of bringing the fuel to the producer, cleaning of fuels and other inconveniences, such as stoppages, will counterbalance this.

In England and Scotland these battery producers have been largely introduced; on the Continent, so far as I know, they were only tried some thirty years ago at a Paris gas works (if I am not mistaken at the Montmartre station). These were Sieman's producers, and were abandoned on account of high fuel consumption. In England it is the practice in a large number of gas works to shut down on Sunday, then any cleaning out of the flues can be attended to, but in our country a gas bench is supposed to be in operation 365 days of 24 hours each in an ordinary year, and 1 day more in leap year, and I think you all realize what a sudden stoppage in the main supply pipe would mean.

Some years ago I made an installation with battery producers for the Erie gas works; these were benches of sixes, and as far as fuel economy was concernd they did better than any other benches of sixes that could be installed when only 2 feet 6 inches is at the disposition between charging floor and top of foundation, and compared favorably with full recuperative benches of sixes, but the inconvenience when firing coal was very much, and they were later fired with coke and gave fair results, but it cost more to run them than to run nines and they were therefore abandoned as soon as the retorts needed renewing.

Of course, producers can be made to make producer gas of soft coal, but in that case it becomes imperative to wash the gas, and you can thereby recover some of the by products, but the cost of installation will scarcely pay for this recovery, while if this producer gas should be sent directly into the main supply, stoppages will be unavoidable and nasty, and besides that the nostrils, where the gas is supplied to the bench, will carbon up on account of the cold gas. I might be said that this gas might be preheated, but I would not advise any one to try this, as that means a reversing regenerator and it takes an expert to handle them. I have handled them personally myself and know what it means.

Therefore, in conclusion, if we will spend the same amount of money that we have to spend on a good battery producer installation on a good separate generator instaliation, and look out for a correct air supply, then the advantages are far with the separate generators; but when, as is the custom in some gas works, every charger attends to his own bench and fires and clinkers it, then naturally the battery producer is better, as in that case there *must* be a special man for the producers; but the aforesaid practice of every stoker attending to his own bench is a very bad practice and should not be permitted.

There are certain cases in which it might be advisable after all to us Battery producers. Let us consider these cases.

1. An old retort house without stage floor is at your disposition and it is inot advisable to build stage floor. Then all the recuperator necessary can be put in 3 feet deep, or at a maximum of 4 feet, and the instalation made economical, but naturally the fuel results wil be bad. It becomes then simply a question of saving 10 per cent., of fuel and paying for new foundations, etc., and stage floor, or installing battery producers. This naturally is a question which has to be looked into in each separate case.

2. The building ground is bad and will sustain a certain weight and no more without resorting to expensive piling or work of that character. In that case, again, the advantage of the separate generator might be overbalanced by the extra cost of foundation.

3. *Inundation.*—Where retort house is subject to frequent inundation and where stage floor is used. In that case you are always sure of a heat supply and the producer can be set above the highest water mark, and from 6 feet to 8 feet in height of retort house can be saved.

4. Freight charges on building material are out of proportion; for instance, from St. Louis to the Pacific Coast. There the extra cost of stage floor height and separate generator might far overbalance the cost of battery producers and so much that the saving of fuel would be counteracted.

Every once in a while you probably hear or read what elegant results were obtained with these battery fired benches, and how much better results they give than the former installation; but what was the former installation? On that point we are generally left in the dark. If battery fired benches are installed for installations where each bench contains from 9 to 12 retorts, each 20 feet long, and then compare it with an old installation of benches of 6's or 8's and 9-foot long retorts, it is not a fair comparison. If they did not give far superior results it would immediately prove that they were absolutely no good. The only just way of comparison is to compare them with installations having the same number of retorts and costing the same amount of money, and where in both cases the benches have been designed and built correctly.

Very often I have heard what elegant results have been obtained by this or that innovation with this or that bench, but the results were only elegant when compared with the former installation, and were sometimes mediocre and sometimes bad when compared with what could have been obtained if the installation had been designed and executed correctly.

When results are given in either percentage of coke made or in pounds of coke per 100 pounds coal carbonized. it should always be known how these results have been arrived at. If, for instance, you give the amount in pounds of coke and say 15 pounds, that would be no more than if somebody else said 10 pounds, if the coke is not weighed hot in either case. Sometimes the results are arrived at by saying, "We make 70 pounds and have left for sale 55 pounds." This 55 pounds is a fact that would mean 15 pounds were used, while another man claims he made only 65 pounds and had 55 pounds left for sale, so he only used 10 pounds, another could claim he made only 55 pounds and had 55 pounds left for sale; he would not use any.

The right way to do with a producer is to weigh the coke, and weigh it dry, and with generators to weigh the coal for every retort, find out how much goes in the generator and determine the correct ratio, care being taken to take into consideration if the retorts for the generator firing are either over, normal or undercharged, as this sometimes makes a tremendous difference.

All in all, let it be understood that the installation of battery producers is just as expensive as the installation of separate generators.

Lastly, I would again recommend that we adopt a designation of battery producers as the name "isolated generators," as explained in the beginning of my paper, is vague and uncertain, as it might just as well refer to an isolated generator for a battery of benches. In England it seems that the term of "outside producer" is mostly used, but it seems to me that the expression "battery producers would be clearer and more definite.

(To be Continued.)

The Vertical Retort from a Practical Point of View.

[A paper read by Mr. Ernest Körting, of Berlin, at the last meeting of the Institution of Gas Engineers, London, England.]

At the present moment there are three systems only of vertical retorts more or less beyond the experimental stage—the Dessau, the Woodall-Duckham and the Settle-Padfield. The three are enumerated according to their degree of similarity to the ordinary practice, beginning with the slightest and finishing with the greatest deviation from the same. The characteristic feature of the existing methods being the thin layer of coal and the free space above the same throughout the whole length of the retort, it is interesting to note that the inventors have in each case given up one of the essential conditions.

Dr. Bueb and Messrs. Woodall and Duckham do entirely away with the free space, and keep the retort always full of coal, with the object

in view of removing all the volatile matter as quickly as possible. Messrs. Settle and Padfield, on the contrary, leave the greater part of the retort without coal, thus creating a heating chamber, in which the bulk of the tar vapors is to be gasified. But there are also important differences between No. 1 and No. 2. The Dessau retort is charged and discharged at intervals, as has been customary since the beginning of the gas industry. The production of gas is comparatively large in the beginning and small towards the end of the carbonization, as in horizontals. but not in the same degree, and corresponds with an initial bottom pressure of several inches against a final one of only some tenths. It is, in consequence, practically impossible to work these retorts with a vacuum, or to work them at all unless they are tight. This circumstance sets a limit to the application of steam, which must not be carried beyond the point of leaving a thin coat of carbon inside the whole length of the retort. The continuous working of the Woodall-Duckham retort, on the other hand, insures a uniform pressure and permits the use of a vacuum, which will counterbalance the effect of any leaks. In consequence, a very large amount of water gas may be produced in this retort, the bottom part of which is always free from carbon. The three systems might, therefore, be classified in the following manner:

1. *Dessau*—Intermittent carbonization in completely full retorts with a limited and arbitrary admission of steam.
2. *Woodall-Duckham.*—Continuous carbonization in a completely full retort combined with an ample, but to a certain degree obligatory, admission of steam.
3. *Settle-Padfield.*—Continuous carbonization in a partly empty retort, combined with gasification of the tar vapors.

Obviously there are here a great variety of aims and methods; and to do them all justice from a practical point of view would require a very intimate knowledge of each different plant and the working results thereof, which the author does not unfortunately possess. He is, therefore obliged to base his remarks mostly on his own experience with the Dessau retort, with a side glance naturally at the other systems, whenever an opportunity occurs.

When criticizing a new system of furnace, the practical engineer will ask first and foremost: "What will be the cost of erection per unit of gas produced?" And the answer must be, that there is not, as far as it is possible to see now, much chance of building a Dessau vertical furnace at a lower price per unit of gas produced than an inclined one. Retorts, generators and recuperation are necessary as in any other oven, and if the props between the retorts are much simplified, the supports and the handling gear of the bottom mouthpieces will counterbalance this advantage. But the retort house will certainly be cheaper in erection. A house of the ordinary type with two rows of furnaces and the hot coke conveyors—not below, but alongside the retorts—will require 10 per cent. less in length and 20 per cent. less in breadth than a house for inclined ones of the same output. There are also structural improvements under consideration, which promise some additional gain.

It is probable that the Woodall-Duckham furnace, with its large output per retort, will be in a still more favorable position with regard to the retort house. The principal advantage, however, of the vertical retort must be looked for in the working results. The gas industry is nowadays in the somewhat precarious position that the demand for, and the cost of, the principal raw material is steadily increasing, whereas the price of gas and all bye-products—with the exception perhaps of ammonia—has a downward tendency. There are fluctuations and interruptions as well as local exceptions in this development; but on the whole the writer fears it must be regarded as a fact. The following table shows the Berlin coal and coke prices for the last 10 years:

Year.	Cost Price of English Coal per Ton.	Selling Price of Coke per Ton.
1896	13s. 2d.	19s. 10d.
1897	13s. 8d.	19s. 8d.
1898	14s. 2d.	16s. 8d.
1899	15s. 11d.	15s. 8d.
1900	25s. 3d.	25s. 3d.
1901	16s. 6d.	24s. 9d.
1902	17s. 1d.	18s. 3d.
1903	16s. 2d.	16s. 2d.
1904	15s. 8d.	16s. 0d.
1905	16s. 3d.	16s. 8d.
1906	17s. 6d.	

For instance, in 1896 13s. 2d. was paid for a ton of English coal, and 19s. 10d. was realized for a ton of coke against 16s. 3d. and 16s. 8d. respectively in 1905. The great problem, therefore, is to find means of materially increasing the production of gas per ton of coal without too much impairing the quality; the standard tacitly accepted in North Germany being a gross heating value of 5,000 calories, or 560 B. T. U.; and it is most gratifying to learn that all three systems of vertical retorts make the claim of producing more thermal units in gaseous form out of a given quantity of coal than was possible hitherto. In highly-heated horizontal retorts, the present make at Berlin per ton of coal is (say) 11,000 cubic feet of 5,050 calories, or 567 B. T. U.; but this can only be done by mixing some Silesian with the Durham coal, in order to avoid thick tar.

The vertical furnace can carbonize English coal alone without the slightest inconvenience. A recent fortnightly trial with good Durham coal (Boldon) gave the following results:

1. *Coal Gas Alone, Without the Admission of Steam*—Gas produced per retort and day, 15,200 cubic feet; gas produced per ton of coal, 11,700 cubic feet; heating value, 614 B.T.U.; illuminating power, 13.5 candles; being the same, or slightly higher than that of gas made in horizontal retorts.

2. *When steam was admitted*, the make per retort increased to 17,250 cubic feet, and the production per tou to 13,250 cubic feet; whereas the heating power still kept at the comparatively high figure of 579 B. T. U., and the illuminating power was red uced to 11 candles. When steam is not admitted to the retorts, water gas may be sent into the hydraulic, as has been also tried in Mariendorf. It may be said that in Dessau vertical retorts, and with the help of steam and water gas, one ton of good Durham coal will yield 13,500 cubic feet of gas. with an average heating value of 560 B.T.U. It is not many years since 10,000 cubic feet per ton of coal was considered a fair production. It cannot be denied, therefore. that substantial progress has been made.

The fuel account will not be abnormal either. It is true the trial furnace requires 16 per cent. on coal carbonized by weight; but as it is standing quite alone, and unprotected from all sides, a considerable reduction is certain as soon as a number of ovens are combined in one block. Other advantages of the gas produced in verticals are the almost entire absence of naphthaline, and a gain in ammonia of 40 to 50 per cent. The coke is of excellent quality—large, dense and hard; and the tar is a light brownish oil, ever so much richer in hydrocarbons than is the ordinary tar, and therefore, in times of a depressed market, it is of a much higher value either as fuel or as gas producing material. These are improvements in the quantity or quality of gas and all its bye-products. They mean nothing less than a step in advance on the whole front of carbonization, and will no doubt result in a more or less considerable monetary gain in each case.

In addition to the high coal prices, labor is the great consideration to the modern gas engineer, and its reduction to the minimum the general desire. In aiming at this object, the vertical retort will be found a good and valuable ally. Messrs. Woodall and Duckham go so far as to promise the entire abolition of retort house labor. According to them the retort house of the future will only require some slight supervision. There is also very little labor in the case of the Dessau furnace—two men only being necessary for the charging and discharging work. The top man has to fill the measuring vessels from the continuous overhead coal hoppers and to let their contents drop into the retorts. His task is by no means so heavy as that of his colleague on the top side of the slopers, for there is no pushing down of coke and no fiery oven in front of him. The other man below has to handle some levers for opening and closing the bottom lids. As the coke will automatically slide over the movable shoot into the hot coke conveyor, there is not much labor in this either, even if the man should be obliged to tickle the coke with a rod in the rare case of a charge not moving out at once.

One of the most objectionable operations in the retort house is, as every gas engineer knows, the auguring. Every Berlin stoker has to give one hour-and-a half out of twelve to this hot and disagreeable task, for all the ascension pipes must be gone through five times a day. Their fortunate colleagues of the verticals will have no experience of this nuisance. It is quite sufficient, if they introduce the augur just once in twenty-four hours. It will go through without resistance; such a thing as thick tar not being known in the gas pipes and hydraulics of a properly-filled and heated vertical retort. There is no scurfing of retorts required either, as the small quantities of carbon deposited on the walls are continuously transformed into water gas.

But all the hot labors associated with the daily programme of the stoker of inclined retorts have not yet been mentioned. He must once a day clean and lubricate all the levers of the top mouthpieces, and

push 8 or 9 red-hot retort charges per day into the generator of each furnace. The top and bottom mouthpieces of the verticals are so cool that they do not require special care, and the generators are large enough for a 36-hours' coke supply. They will be charged (say) once in twenty-four hours from an overhead hopper, and in the easiest way. It will be seen, therefore, that the stokers will have their work considerably reduced.

But the principal advantage is the long hours of distillation. With Durham coal and a maximum admission of steam, 12-hour charges will brobably be found most convenient, and prove to be very suitable for the 8 hour day. One might, for instance, make a charge every four hours—say, at 9 o'clock, 1 o'clock, and 5 o'clock in the day time, as well as at 9, 1 and 5 o'clock in the night and morning. The 3 day charges would be made by one 8-hour shift, and the three night charges by another 8-hour shift, no man and no work being necessary in the four hours interval left each time between the two. In other words, the long hours of distillation would make it possible to work 8-hours with only two shifts in twenty-four hours; and these shifts might commence and finish their work at hours fitting excellently into the ordinary routine of family life. It is obvious that all these advantage must cause a considerable reduction in the cost of labor as well. But as the inclined and the mechanical stokers have done already so much in this respect, the gain cannot be so important as it was with them. Nowadays so much is heard about the grievance of the working man that the other less numerous, but far more patient, beast of burden, the engineers, do not appear to come into consideration at all. Nevertheless it may be mentioned that the vertical retort has for him also some relief and some benefits in store. Simplicity of construction and supervision cannot be regarded as merits of the Coze oven. It is, however, very easy to regulate the heating of a Dessau furnace; and the Woodall-Duckham system does not require any regulating at all—the combustion on the top securing uniform heats as a matter of course.

Very often gas-works are blessed with fault-finding neighbors, and then the retort house is a continuous reason for complaints. Here, again, the engineer may welcome the vertical retort as a helpful friend. Messrs. Woodall and Duckham promise him a retort house similar to a workshop, and perfectly free from dust and vapor; and the Bueb furnace, after having done away with the scurfing, does not send forth any more black clouds of smoke from the chimneys, and reduces the nuisance of charging and discharging by 50 per cent., owing to its long hours of destillation. There is also every reason to believe that the engineer will be pleased with the durability of the vertical system. A vertical retort, quite free from outside pressure, always brimful, and never, or very rarely, submitted to the sore trial of scurfing, fulfils, one would imagine, all the conditions necessary for a lengthy life—so long, of course, as it is not exposed to dangerous temperatures. The top half of the Dessau retort is so cool that it must remain in good working order for a very long time indeed. This will be the case in a still higher degree with the bottom half of the Woodall Duckham retorts; for it is kept comparatively cool from the outside, and has always the same temperature on the inside, being, into the bargain, never emptied as long as the furnace is in action.

The foregoing statement is so far merely an enumeration of advantages. The author is therefore prepared for the question: Where do the drawbacks and limits of the vertical retorts occur? A question, however, which he is only able to answer with regard to the Dessau system. It is certainly a disadvantage that some coals expand during carbonization, and do not quite automatically slide out of the retort. Germany, for instance, is in possession of three important coalfields—the Ruhr or Westphalian, the Saar, and the Silesian. All the Ruhr and Saar coals tested till now are excellently adapted for the vertical retort; but several of the best marks of Silesia coals are decidedly not so. Among the numerous other coals—viz., French, Belgian, Durham, Yorkshire, etc.—that have been tried, none have been found to be unsuitable, although the so-called creeping coals are not quite so satisfactory. Similar differences, however, may be observed in all sorts of retorts. The Silesian coke, for instance, being small, hard and brittle, causes much friction, and is by no means easily discharged from slopers or horizontal through retorts, which moreover are liable to lose their shape and part of their efficiency at a comparatively early age. Fortunately, it seems that properly heated verticals retorts keep in good form to an astonishing degree. The Mariendorf retorts, after 300 working days, are in excellent condition.

Rebus sic stantibus, one may say that the vertical retort is at present in the following position from a practical point of view: It is already certain that there are a number of advantages, and also one or two drawbacks, connected with the new method of carbonizing in vertical retorts; and no doubt more than one gas engineer would be willing to adopt it. But there is such an *embarras de richesses* in designs and possibilities that he cannot make up his mind which to adopt Three diffrent systems are already more or less past the experimental stage; others are announced as being tried; and, in addition, there are well known gas engineers publishing their theories on verticals and giving detailed designs as to how they ought to be developed. It is, of course, at all times a rare intellectual pleasure to watch a well trained brain occupied with an invention, but a certain danger will be always connected with technical or chemical speculation. Nobody can foretell how the finest theory will stand the fire of practical trial. One missing link, one slight discrepancy, may wreck the whole train of deduction, especially on such an obscure subject as carbonization.

The great technical periodicals in Germany therefore follow the rule that the plants must be built and processes tried before the designs and descriptions of them are accepted for publication; for the average engineer and reader looks at things from a practical point of view, and wants experience, facts and figures. The initiation of the Bueb retort was quite in accordance with these ideas. After a full trial of the furnace in Dessau, a complete account was published, the results of which were afterwards controlled and confirmed at Mariendorf. It was then known that by the simple means of putting the retort upright, without any complication by machinery, etc., noteworthy results were obtainable. This knowledge was sufficient to induce quite a number of Continental gas works to adopt the new system, which before long will be tried in many different places. But it seems to be the general idea in England that, by a more elaborate application of heats, and by a continuous process, much better results can be obtained. From a practical point of view, it is, of course, of the utmost importance to know as soon and as fully as possible whether this is really the case. The results of the Woodall-Duckham furnace especially will throw much light on the interesting points, and the publication of them is highly desirable; the following questions being essential:

1. What is the amount of fuel per ton of coal carbonized?
2. What is the quantity per ton, and per retort, and the heating value of the gas produced?
3. No. 2 being of great imporsance, by what means has it been secured that always good average samples of the gas are taken for analyzing purposes? [It may be mentioned here that in the Dessau Gas Works for a long time trial furnaces were the only ones in action, and that in Mariendorf a small holder is provided for testing purposes, which is filled each time within 24 hours, taking absolutely equal quantities of gas per unit of time.]
4. By what means is the taking of good coal samples secured for analyzing purposes, for as it is not probable that the eventual gain in heating power is in excess of the differences constantly found in the quality of our coals, it is absolutely necessary to control the results of the trial furnace by daily coal analyses.

Whatever the results may be, one conclusion seems definitely established—viz., that the vertical retort is of great practical importance, and that engineers of all nations will be thankful to anyone who undertakes the irksome task of making trials in a new direction, and of publishing his results. Cordial acknowledgement is also due to all those corporations and boards of directors who have regarded it as a *nobile officium* to grant means for researches. There will be no victors and vanquished either in his peaceful international contest. For all the results are of value to the practical engineer—the successes as well as the candidly avowed failures. Let us hope, that the combined effort of so many engineers and so many nations will bring a good harvest of success to the old industry, born and brought up like so many of her sisters, on the fertile ground of this country.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Columbus (O.) Gas and Fuel Company awarded J. Alex. Mayers, of New York, a contract to install a complete coal gas plant on the West side of the city. The disposition of the sub-contracts was as follows: Benches, the St. Louis Gas Construction Company, of St. Louis, Mo., Buildings, foundations and exccavation, Ewers Bros. of Columbus, Condensing, washing, scrubbing, tar extracting, exhausting, purifying, metering and concentrating apparatus. The Gas Machinery Company of Cleveland, plumbing steam heating, etc. The Sam. Esswein Company of Columbus, O., supervising architect, F. L. Packand, of Columbus, O.

THE Gas Meter Workers' Union, of Albany, N. Y., is unique among labor unions of the country. It being the only one of that craft

in existence, its objects are principally to promote good fellowship among the employees, and to keep abreast with the workers of other crafts. It is not compulsory on the workers in that factory to become members of the union.

THE Home Gas Company, of Los Angeles, Cal., a new concern, does not propose to be bucked out of business by the San Bernardino Gas and Electric Company, which is a branch organization of the Pacific Light and Power Company. When the Home Company organization was established the gas rate was $2.50. It dropped to $1 and the new company met the cut. June 1 the old company made a cut to 75 cents, and at a meeting of the stockholders of the Home Company it was decided to stand pat and furnish good gas at $1 per thousand. Both are probably losing money.

THE Detroit (Mich.) City Gas Company has employed 20 men to take out 30,000 duplicate meters made useless through the uniform price of 80 cents per 1,000 feet. At the rate the men are now working the job will last about two years.

THE Lowell Gas Light Company has one of the prettiest small gardens in the city of Lowell, Mass.

ARTICLES of incorporation of the Jamestown (N. D.) Gas Company have been received. H. P. Taylor President of the Company, O. C. Wonnerberg Vice-President, and A. D. Grant Secretary and Treasurer.

AT the June meeting of the City Council, of Bangor, Me., Alderman Charles R. Dunton presented the report of the committee appointed several months ago to investigate the price of gas. The striking feature of the report, which was accepted by both boards, is contained in its last paragraph, which advocates that the city take one-half the capital stock of the Bangor Gas Light Company, have an equal interest in the company's management, and in 1921 take the remainder of the stock. In other words, it advocates ultimate municipal ownership. Bangor is looking for trouble.

OHIO and Indiana gas and oil men will spend a half million dollars in Oklahoma, giving to Ardmore, the capital of Indian Territory, an artificial gas plant, and furnishing the product to Fort Worth and Dennison, Tex. The men at the head of the company are: J. D. S. and Lemuel G. Neely, of Lima, O.; John Kerr, E. R. Curtain, James Murdock and sons, Samuel T. and Charles Murdock, of Lafayette, Ind. Two years ago Daniel Herring, an oil man, obtained a gas franchise for Ardmore, but failed to float his company, and the gas men of Ohio and Indiana took up the proposition at the lapse of the option, securing new franchises in Ardmore, Dennison and Fort Worth, Tex.

THE Board of City Trustees of Ambrose, Cal., have sold the franchise for the new gas plant, which is to be located there, for $60. The company intends to put in plant costing in the neighborhood of $50,000, and will lay mains in all parts of the city for heating and lighting purposes. Mr. Potter, of Oakland, is the President of the company, and George W. Edwards, of Oakland, is its expert and manager. The rate was fixed at $1.50 per 1,000 feet to start, with the understanding that it will be reduced to $1 per 1,000 as soon as there is enough used to warrant this reduction.

HENRY C. PAUL, of Fort Wayne, Ind., was appointed receiver for the Fort Wayne Gas Company by Judge Anderson, of the Federal Court. The appointment of a receiver was asked for in a bill of complaint filed by the Central Trust Company, of New York, against the Fort Wayne Gas Company. According to the complaint, the trust company was trustee on a bond issue of $2,000,000 made in January, 1895, and payable January 1, 1925, and held a first mortgage on the property of the defendant gas company in Allen, Wells, Blackford, Jay, Grant, Delaware and Madison, to secure the bond issue. It is alleged that the gas company failed to pay the semi-annual interest due on the bond issue, January 1, 1906, and has not since then paid the interest, which amounts to $60,000.

THREE RIVERS, Mich., has a gas franchise mixture on its hands. There have been issued in the last few years several franchises, but nobody has smelled the gas yet.

THE Federal Gas Company has obtained a franchise to install a gas plant at Weatherford, Tex.

THE price of artificial gas at Akron, O., which the city is not to have anyhow while natural gas holds out, is to be left to the future.

THE New Orleans (La.) Gas Company has declared a stock dividend of $3 per share, payable July 15th.

AT Wichita (Kas.), five men were seriously injured and much damage done to property by explosion of gas. One of the men was hunting a leak with a light.

THE Peoples Gas Saving Company, Cleveland, O., $25,000, was incorporated by John H. Price, Grant B. Hamlin, DeWitt C. West, E. C. Gessner and D. E. Phillips.

ANNOUNCEMENT was made that the deal for the merger of the two artificial gas companies of Cleveland, O., the Cleveland Gas Light and Coke Company, and the Peoples Gas Company, is off temporarily at least. The merger was to be brought about by lease to a syndicate headed by A. S. White and others of New York. President Greenough, of the Cleveland Gas Light and Coke Company, says that legal complications have arisen which prevented a ratification of the lease now, but that it would probably be effected this fall.

POOR ventilation was the cause of another man's death. This time at Peoria, Ills. The young man retired to the bath room about 6:30. A new gas heater was recently installed of the variety which has no flue to carry away the fumes from the heater. The only window in the room was tightly closed and the temperature of the air very high; 25 minutes later, his father, alarmed at the young man's long absence, went to call him, and found him dead. We mention these items, as there seems as if Gas Companies should adopt the rule of not permitting their customers to instal gas using devices that are not properly connected with a flue of some kind.

AT the Council committee meeting in Boston, Mass., when the public was supposed to make its demand for municipal ownership, the only two spectators prsesent were two gas and electric light men—it is easily imagined that there was no particular howl for municipal ownership.

THE Consolidated Light Heat and Power Company, Toronto, has been incorporated with a capital of $2,000,000, to manufacture gas, electricity, etc. The provisional directors include J. W. Mitchell, A. Oakley, and C. W. Fleming, Toronto.

A WORKMAN at Lynn, Mass., was badly injured from an explosion, caused by hunting a gas leak with a light.

A MAN at Pittsburgh, Pa., is in a serious condition from explosion, he also was hunting a leak with a light. Are the Gas Companies warning their men and gas users sufficiently on this point?

A POWDER made from peat found in the Oswegatchie river near Ogdensburg, N. Y., is said to be excellent for making gas, a company is installing machinery at Heuvelton, N. Y. to produce the dried peat.

GAS is being piped from Berkeley Col., to Point Richmond, by the Oakland Gas Light and Heating Company.

THE gas company endeavoring to get a franchise at Tacoma, Wash., has offered gas at $1 per 1,000.

IN the case of Hull & Co., of Chicago, western agents, against the Key City Gas Company, of Dubuque, Ia., a verdict of $3,000 for defendant was returned. The case arose out of a contract made in Dubuque in 1902 by Mr. George McLean for the gas company and a salesman for Hull & Co., whereby the latter agreed to deliver 10,000 tons of coal within a certain time at a certain price. The contract was drawn by Mr. McLean and did not contain some of the provisions which Hull & Co's. agent in a secret letter from his principals had been directed to obtain. Later on, the price of coal having meanwhile advanced, Hull & Co. repudiated the contract and alleged that their agent had no authority to sign contracts in writing binding them. They sued to recover $488 for the coal they had delivered, obtaining service on Mr. McLean in Chicago, and the gas company responded with a counter claim for damages for non-performance of contract.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Le noke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JULY 9, 1906.

The Market for Gas Securities.

The Directors of the United Gas and Electric Company, of New Jersey, have declared the regular semi-annual dividend of 2½ per cent. on the preferred stock, also an initial dividend of 2 per cent. on the common stock of the company, both payable July 16, to stockholders of record July 2, 1906. The surplus earnings of the constituent companies of the United Gas and Electric Company are as follows for the year May 1:

1905.	1905.	Change.
$443,573	$355,975	Inc. $87,598

Attorney Lawrence Maxwell, Jr., has been selected to draw up the lease whereby the Cincinnati Gas and Electric Company will be turned over to the Union Gas and Electric Company under a guarantee of dividends. The city has sanctioned the lease.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JULY 9.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	140¼	140¾
Central Union, Bonds, 5's	3,000,000	1,000	101	104
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	3,300,000	1 000	118	120
Mutual	3,500,000	100	225	250
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.—				
Bonds, 5's	11,000,000	1,000	103	105
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	101	103
New York and East River				
Bonds, 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	120	130
" " Bonds(5's)	15 000,000	1,000	108	112
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (5's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	103½	103¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	80
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston—				
Common	25,000,000	100	58¾	59
Preferred	25,000,000	100	87¾	88
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 5's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	89¼	90
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,500,000	20	300⅝	301
First mortgage 6's	500,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 61
Baxter & Young, Detroit, Mich 79
B. E. Chollar, St. Louis, Mo 72
Cruse-Kemper Co., Philadelphia, Pa 68
David Leavitt Hough, New York City 79
Davis & Farnum Mfg. Co., Waltham, Mass 80
Economical Gas Apparatus Construc'n Co., Toronto, Ont 61
Frank D. Moses, Trenton, N. J 80
Fred. Bredel Co., Milwaukee, Wis 78
Frederic Egner, Washington, D. C 84
H. M. Byllesby & Co., Chicago, Ills 67
Humphreys & Glasgow, New York City 81
Isbell-Porter Co., Newark, N. J 68
J. F. W. Jost, Philadelphia, Pa 69
Kerr Murray Mfg. Co., Fort Wayne, Ind 80
The Gas Machinery Co., Cleveland, O 64
The Jeffrey Manufacturing Co., Columbus, O 78
United Gas Improvement Co., Philadelphia, Pa 75
Western Gas Construction Co., Fort Wayne, Ind 88

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 61
Bartlett, Hayward & Co., Baltimore, Md 81
Baxter & Young, Detroit, Mich 79
Connelly Iron Sponge & Governor Co., New York City 77
Continental Iron Works, Brooklyn, N. Y 82
Cruse-Kemper Co., Philadelphia, Pa 68
Davis and Farnum Mfg. Co., Waltham, Mass 80
Deily & Fowler, Philadelphia, Pa 84
Economical Gas Apparatus Construc'n Co., Toronto, Ont 61
Empire Gas Construction & Improvement Co., N. Y. City 69
Frank D. Moses, Trenton, N. J 80
Fred. Bredel Co., Milwaukee, Wis 78
G. Shepard Page's Sons, New York City 79
Humphreys & Glasgow, New York City 81
Isbell-Porter Company, New York City 68
Kerr Murray Mfg. Co., Fort Wayne, Ind 80
Lloyd Construction Co., Detroit, Mich 70
Logan Iron Works, Brooklyn, N. Y 84
Quintard Iron Works, New York City 81
R. D. Wood & Co., Philadelphia, Pa 82
Riter-Conley Mfg. Co., Pittsburgh, Pa 83
Stacey Mfg. Co., Cincinnati, O 83
The Gas Machinery Co., Cleveland, O 64
The Jeffrey Manufacturing Co., Columbus, O 78
United Gas Improvement Co., Philadelphia, Pa 75
Western Gas Construction Co., Fort Wayne, Ind 88

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 81
B. E. Chollar, St. Louis, Mo 72
California Light and Fuel Co., San Francisco, Cal 62
Economical Gas Apparatus Construc'n Co, Toronto, Ont. 61
Fred. Bredel Co., Milwaukee, Wis 78
Humphreys & Glasgow, New York City 83
The Gas Machinery Co., Cleveland, O 64
United Gas Improvement Co., Philadelphia, Pa 75
Western Gas Construction Co., Fort Wayne, Ind 88

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N. Y 82
Cruse-Kemper Co., Philadelphia, Pa 68
Davis & Farnum Mfg. Co., Waltham, Mass 80
Economical Gas Apparatus Construc'n Co., Toronto, Ont 61
Fred. Bredel Co., Milwaukee, Wis 78
Isbell-Porter Co., Newark, N. J 68
Kerr Murray Mfg. Co., Fort Wayne, Ind 80
Logan Iron Works, Brooklyn, N. Y 84
R. D. Wood & Co., Philadelphia, Pa 82
Riter-Conley Mfg. Co., Pittsburgh, Pa 83
Stacey Mfg. Co., Cincinnati, O 83
The Gas Machinery Co., Cleveland, O 64
Western Gas Construction Co., Fort Wayne, Ind 88

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 61
R. D. Wood & Co., Philadelphia, Pa 82

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 61
Fred. Bredel Co., Milwaukee, Wis 78
Isbell-Porter Co., Newark, N. J 68
Kerr Murray Mfg. Co., Fort Wayne, Ind 80
Stacey Mfg. Co., Cincinnati, O 83
The Gas Machinery Co., Cleveland, O 64
Western Gas Construction Co., Fort Wayne, Ind 88

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis 78
Kerr Murray Mfg. Co., Fort Wayne, Ind 80
Michigan Ammonia Works, Detroit, Mich 60
The Gas Machinery Co., Cleveland, O 64
Western Gas Construction Co., Fort Wayne, Ind 82

GAS METERS.

American Meter Co., New York and Philadelphia. 87
Detroit Meter Company, Detroit, Mich..... 87
D. McDonald & Co., Albany, N. Y..... 85
Helme & McIlhenny, Philadelphia, Pa..... 87
John J. Griffin & Co., Philadelphia, Pa. 44
Keystone Meter Co., Royersford, Pa..... 84
Maryland Meter and Mfg. Co., Baltimore, Md..... 84
Metric Metal Co., Erie, Pa..... 85
Nathaniel Tufts Meter Co., Boston, Mass..... 84
New York Improved Meter Co., New York City 86
Pittsburgh Meter Co., Pittsburgh, Pa..... 85
Rotary Meter Co., New York City..... 63

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 87
D. McDonald & Co., Albany, N. Y..... 85
Helme & McIlhenny, Philadelphia, Pa..... 87
John J. Griffin & Co., Philadelphia, Pa..... 44
Keystone Meter Co., Royersford, Pa..... 86
Nathaniel Tufts Meter Co., Boston, Mass..... 86
New York Improved Meter Co., New York City..... 86
Pittsburgh Meter Co., Pittsburgh, Pa..... 85

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City 86
Reeves Mfg. Co., New Haven, Conn..... 83

WATER METERS.

Pittsburgh Meter Co., Pittsburgh, Pa..... 85

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 80
Donaldson Iron Co., Emaus, Pa..... 72
Economical Gas Apparatus Construc'n Co., Toronto, Ont. 61
R. D. Wood & Co., Philadelphia, Pa..... 82
Warren Foundry and Machine Co., New York City..... 72

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 78
Perkins Co., New York City..... 78
Westmoreland Gas Coal Co., Philadelphia, Pa..... 79

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 66

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City..... 72

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 66

GAS TAPPING MACHINES.

George Light, Dayton, O..... 72
H. Mueller Manufacturing Co., Decatur, Ills..... 70

CANNEL COALS.

Perkins & Co., New York City..... 78

STOKING MACHINERY.

G. A. Bronder, New York City..... 79

CONVEYORS.

Adam Weber Sons, New York City..... 76
Cruse-Kemper Co., Philadelphia, Pa..... 68
C. W. Hunt Company, New York City..... 71
Dodge Coal Storage Co., New York City..... 72
Economical Gas Apparatus Construc'n Co., Toronto, Ont 61
Fred. Bredel Co., Milwaukee, Wis..... 78
G. A. Bronder, New York City..... 79
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
The Gas Machinery Co., Cleveland, O..... 64
The Jeffrey Manufacturing Co., Columbus, O..... 78
The Link-Belt Engineering Co., Philadelphia, Pa..... 71
The Link-Belt Machinery Co., Chicago, Ills..... 72
Western Gas Construction Co., Fort Wayne, Ind..... 88

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 79
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
Stacey Mfg. Co., Cincinnati, O..... 88

GAS ENRICHERS.

Standard Oil Co., New York City..... 79
Sun Company, Pittsburgh, Pa..... 79
The Sun Oil Co., Pittsburgh, Pa..... 79

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 79
Fred. Bredel Co., Milwaukee, Wis..... 78
The Jeffrey Manufacturing Co., Columbus, O..... 78

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 70

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 70

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 64

GAS GOVERNORS.

Connelly Iron Sponge & Governor Co., New York City. 77
Fred. Bredel Co., Milwaukee, Wis. 78
Isbell-Porter Co., Newark, N. J..... 68
Johnson-Reynolds Co., Anderson, Ind..... 79
Pittsburgh Meter Co., Pittsburgh, Pa..... 85
R. D. Wood & Co., Philadelphia, Pa..... 82

CEMENTS.

C. L. Gerould, Pittsburgh, Pa..... 76
F. W. Stanley, New York City..... 76

RETORTS AND FIREBRICKS.

Adam Weber Sons (Albert J. Weber's Construction).. 76
Baltimore Retort and Firebrick Co., Baltimore, Md.. 76
Brooklyn Firebrick Works, Brooklyn, N.Y..... 76
Henry Maurer & Son, New York City..... 76
James Gardner, Jr., Co., Pittsburgh, Pa..... 76
J. H. Gautier & Co., Jersey City, N. J..... 76
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 64
Missouri Firebrick Co., St. Louis, Mo..... 76
National Pyrogranit Co., New York City..... 76
Parker-Russell Mining and Mfg. Co., St. Louis Mo.... 77
St. Louis Gas Construction Co., St. Louis, Mo..... 76

(Continued on page 61.)

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OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
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PHILADELPHIA, PA., June 13, 1906.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 14th, 1906, to stockholders of record at the close of business, June 30, 1906. Checks will be mailed.

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(*Concluded from page* 60.)

INCLINED RETORTS.

Adam Weber Sons (Graham-Morton [England] System) 76
Baltimore Retort and Firebrick Co., Baltimore, Md..... 76
Fred. Bredel Co., Milwaukee, Wis..... 78
Parker-Russell Mining and Mfg Co., St. Louis, Mo..... 77
St. Louis Gas Construction Co., St. Louis, Mo..... 76

VERTICAL S'S.

Adam Weber Sons, New York City..... 76
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 77
Fred. Bredel Co., Milwaukee, Wis..... 78
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 77
St. Louis Gas Construction Co., St. Louis, Mo..... 76

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City..... 76

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 76
Baltimore Retort and Firebrick Co., Baltimore, Md 76
Bartlett, Hayward & Co., Baltimore, Md..... 81
Fred Bredel Co., Milwaukee, Wis..... 78
J. H Gautier & Co., Jersey City, N. J..... 76
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 6
Missouri Firebrick Co., St. Louis, Mo..... 76
Parker-Russell Mining and Mfg. Co., St Louis, Mo. ... 77
St. Louis Gas Construction Co., St. Louis, Mo..... 76

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N Y..... 84
Davis & Farnum Mfg Co., Waltham, Mass..... 80
Fred. Bredel Co., Milwaukee, Wis..... 78
Isbell-Porter Co , Newark, N. J..... 68
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
Logan Iron Works, Brooklyn, N. Y..... 84
R. D. Wood & Co., Philadelphia, Pa..... 82
Stacey Mfg. Co., Cincinnati, O..... 83
The Gas Machinery Co., Cleveland, O..... 64
Western Gas Construction Co., Fort Wayne, Ind..... 88

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 76

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 22
General Gas Light Co., Kalamazoo, Mich..... 65
Geo. G. Ramsdell, New York City..... 94
Welsbach Company, Gloucester, N. J..... 74

BURNERS.

M. Steward Mfg. Co., Chattanooga, Tenn.. 22
Wm. M. Crane Co., New York City.. 66

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 22

STREET LAMPS.

Thos. T. W. Miner, New York City 72
Welsbach Street Lighting Co., New York and Phila... 74

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City.. 77
Cruse-Kemper Co., Philadelphia, Pa..... 68
Davis & Farnum Mfg. Co., Waltham, Mass..... 80
Fred. Bredel Co., Milwaukee, Wis. 78
Isbell-Porter Co., Newark, N. J..... 68
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
R. D. Wood & Co., Philadelphia, Pa..... 84
Stacey Mfg. Co., Cincinnati, O..... 83
Western Gas Construction Co., Fort Wayne, Ind. 88

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City.. 77
Greenpoint Chemical Works, Brooklyn, N. Y..... 60

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 82
Davis & Farnum Mfg. Co., Waltham, Mass..... 80
Economical Gas Apparatus Construc'n Co, Toronto, Ont 61
Isbell Porter Co., Newark, N. J..... 68
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
Ludlow Valve Manufacturing Co., Troy, N. Y..... 69
R. D. Wood & Co., Philadelphia, Pa..... 84
Stacey Mfg. Co., Cincinnati, O..... 83
The P. H. & F. M. Roots Co., Connersville, Ind..... 71
Western Gas Construction Co., Fort Wayne, Ind..... 88

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City.. 77
Connersville Blower Co., Connersville, Ind 62
Davis & Farnum Mfg. Co., Waltham, Mass..... 80
Isbell-Porter Company, Newark, N. J..... 68
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
The P. H. & F. M. Roots Co., Connersville, Ind..... 71

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 64
Western Gas Construction Co., Fort Wayne, Ind..... 88

GAS STOVES.

American Meter Co., New York and Philadelphia..... 87
Keystone Meter Co., Royersford Pa..... 86
Maryland Meter & Manufacturing Co., Baltimore, Md.. 86
Nathaniel Tufts Meter Co., Boston, Mass..... 86

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 67

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y 72

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 81
Continental Iron Works, Brooklyn, N. Y..... 82
Cruse-Kemper Co., Philadelphia, Pa. 68
Davis & Farnum Mfg. Co., Waltham, Mass,..... 80
Delly & Fowler, Philadelphia, Pa..... 84
Economical Gas Apparatus Construc'n Co., Toronto, Ont 61
Kerr Murray Mfg. Co., Fort Wayne, Ind. 80
Logan Iron Works, Brooklyn, N. Y..... 84
R. D Wood & Co., Philadelphia Pa. 82
Riter Conley Mfg. Co., Pittsburgh, Pa..... 83
Stacey Mfg Co, Cincinnati, O..... 83
Western Gas Construction Co., Fort Wayne, Ind..... 88

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 80
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 80
Stacey Mfg Co., Cincinnati, O 83
Western Gas Construction Co., Fort Wayne, Ind 88

PAINTS.

American Standard Composition Co., New York City.. 67

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C. 64

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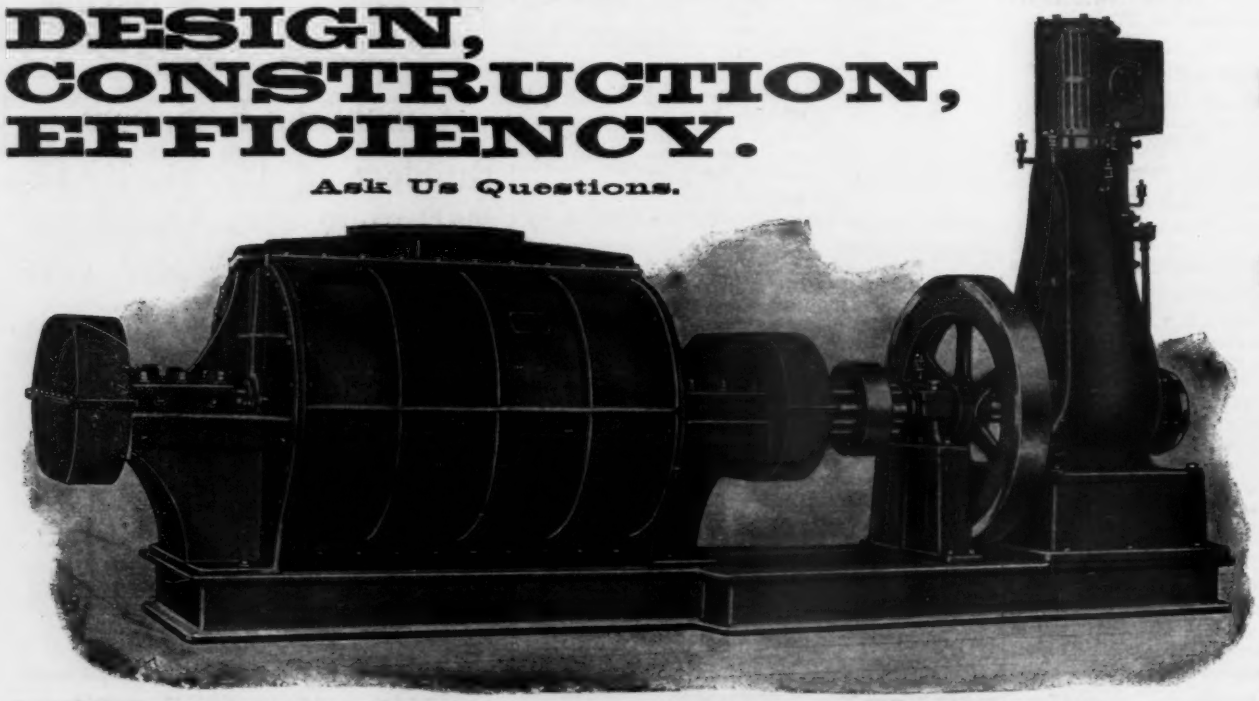

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ROTARY STATION METER

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Name of Company.	Hourly Capacity.	To Measure.
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Amsterdam Gas Works, Holland	30,000	Coal Gas Make.
British Gas Light Co., Norwich	3,500	Oxide Revivification.
" " " " Etruria	30,000	General Works Meter.
" " " " Hull	1,500	Oxide Revivification.
Cleckheaton Gas Co	30,000	General Works Meter
Cleethorpes Gas Co	25,000	Water Gas Make.
Croyden Commercial Gas and Coke Co	3,500	Oxide Revivification.
" " " "	80,000	Carburetted Water Gas.
" " will install	180,000	General Works Meter.
Danish Gas Works, Fredriksburg, Denmark	100,000	Coal Gas Make.
Elstev Gasmeterfabric, Rotterdam, Holland	2,800	For Testing Meters.
Gas Light and Coke Co., London	5,000	Oxide Revivification.
" " "	3,500	" "
" " "	3,500	" "
Gas Anstalt, Hanover, Germany	100,000	General Works Meter.
Halifax Corporation	100,000	Ca buretted Water Gas.
Hastings and St. Leonards Gas Co	100,000	General Works Meter.
Hanover Gas Works, Hanover, Germany	100 000	" " "
Kidderminster Gas Light and Coke Co	60,000	" " "
Liverpool United Gas Co	10,000	Oxide Revivification.
Shanghai Gas Co	40,000	Carburetted Water Gas.
" "	75,000	Mixed Coal and Water Gas.
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South Staffordshire Gas Co	(70 with capacity from) 2,800 to 500,000	Producer Gas.
Stockholm Gas Co., Sweden	100,000	Mixed Coal and Water Gas.
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We have been permitted by the recipients, an American constructing concern, to reproduce the following letters recently received in reply to inquiry respecting Rotary Station Meters made of three important English gas works' engineers, all of whom enjoy enviable reputations and are everywhere among their fellow workers recognized for the skill, ability and success which has attended their administrations of the properties with which they are connected. The originals of these letters, together with many more of similar tenor, are on file in our office and open to the inspection of any prospective purchaser of Rotary Station Meters.

DEAR SIRS:

In answer to yours of the 27th March, I have pleasure in stating that we have had an 80,000 cu. ft. per hour Rotary Station Meter in use in connection with our Water Gas Plant for almost 18 months; during the greater part of this time we worked in series with our ordinary station meter, and found its registration accurate. I am so satisfied with it that I am about to place an order with the firm for a meter to pass 180,000 cu. ft. per hour of coal gas.

Yours faithfully, _____

DEAR SIRS:

In reply to your enquiry of the 27th March *re* Rotary Meter, I have not the slightest hesitation in stating that the meter we have in use here is giving every satisfaction.

It is 15,000 cu. ft. per hour and fixed at the outlet of Condensers of our Carburetted Water Gas Plant, and of course in the inlet of the Relief Holder, and is working under extreme conditions.

It is fixed underground, and since we have had it, *viz.*, 3 years, we have only taken it out once for examination (and this out of curiosity); as you will quite understand, there is a lot of oil, tar, etc., in contact with the meter at this point, and we thought it might be getting clogged up, but were pleased to find that such was not the case.

From our experience we have not the slightest hesitation in recommending its adoption to all gas makers.

I shall be pleased to reply further if necessary.

Yours very faithfully, _____

GENTLEMEN:

In reply to yours of March 27th respecting the Rotary Station Meter in use at these Works, I beg to inform you that the same has given every satisfaction. The meter has been registering the whole of the gas made at our Inclined Retort Section for the past 21 years, and up to the present time we have not had the slightest trouble. The capacity of our meter is 100,000 cu. ft. per hour.

Yours truly, _____

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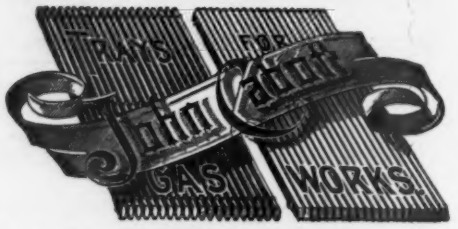

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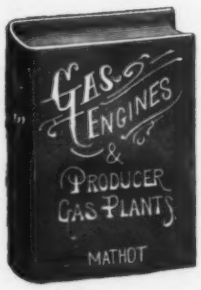

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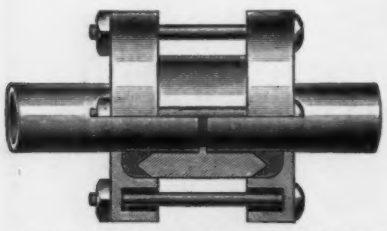
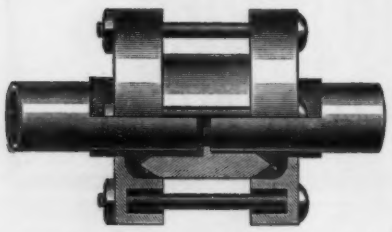
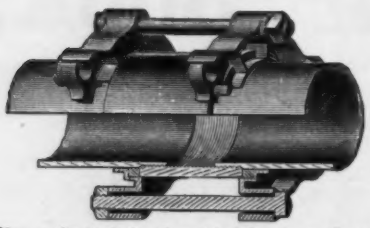

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.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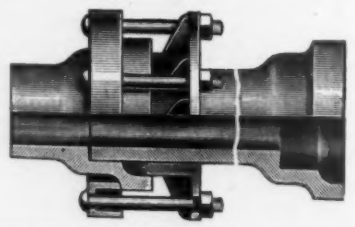
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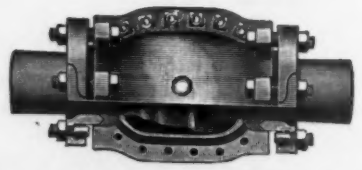
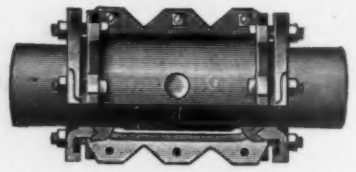
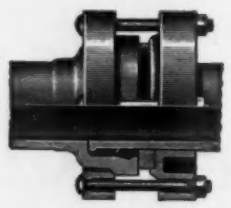

Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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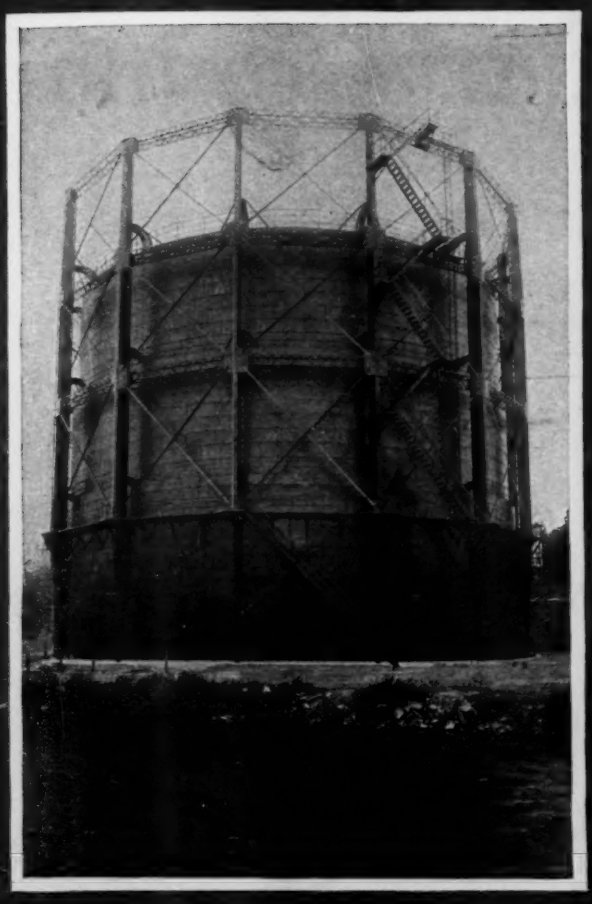

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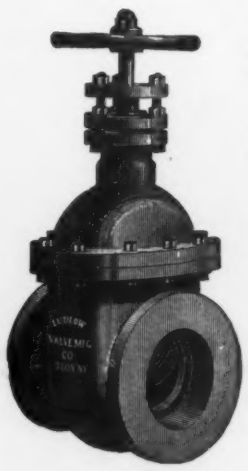

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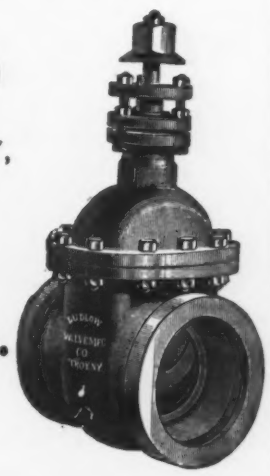

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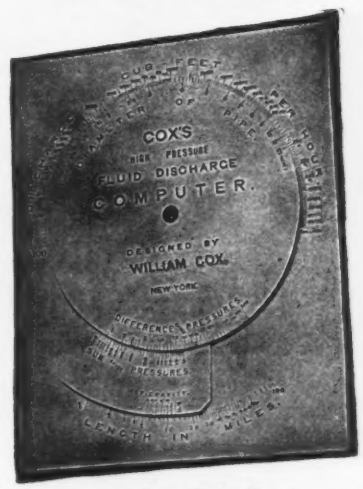

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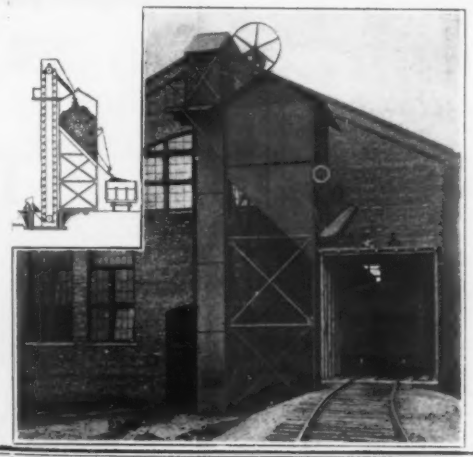

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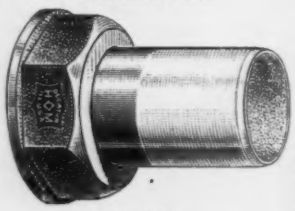

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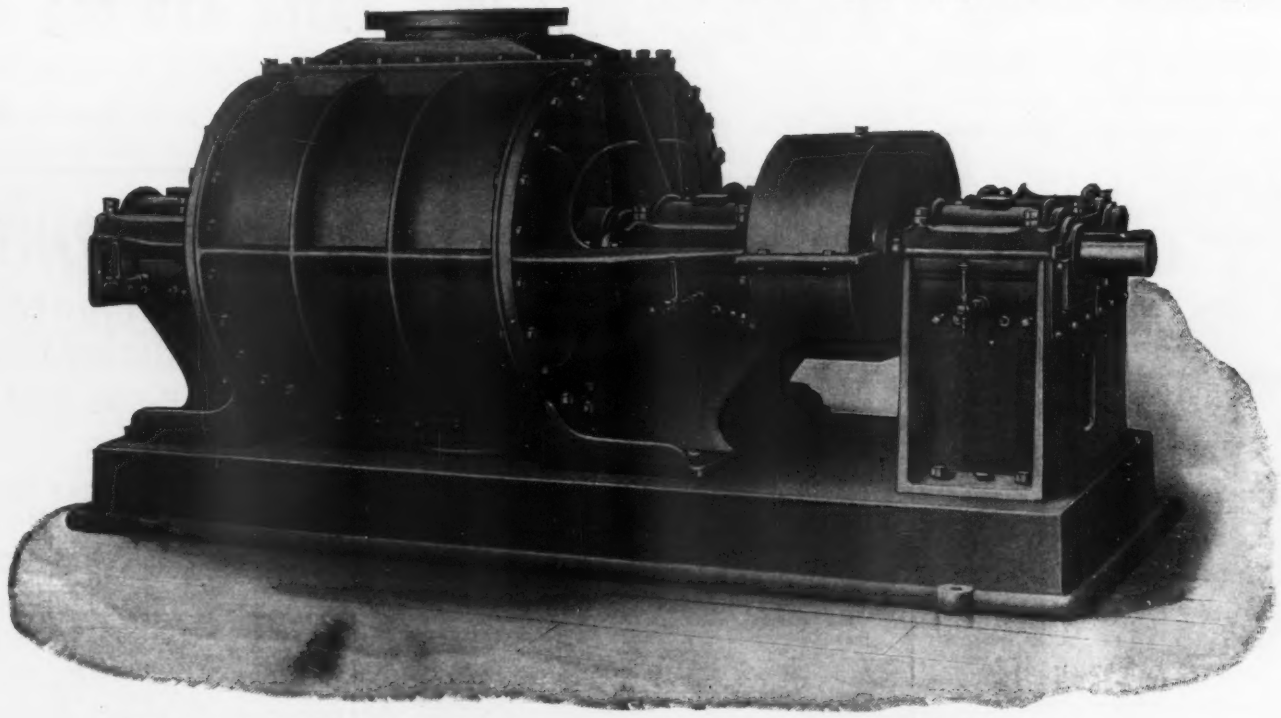

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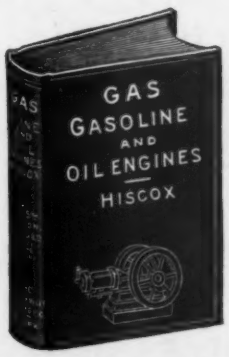

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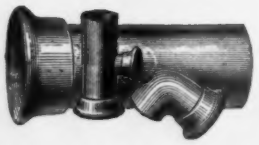

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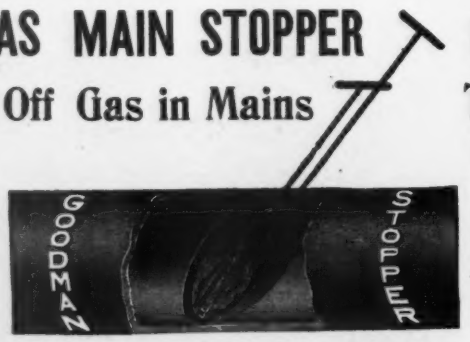

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

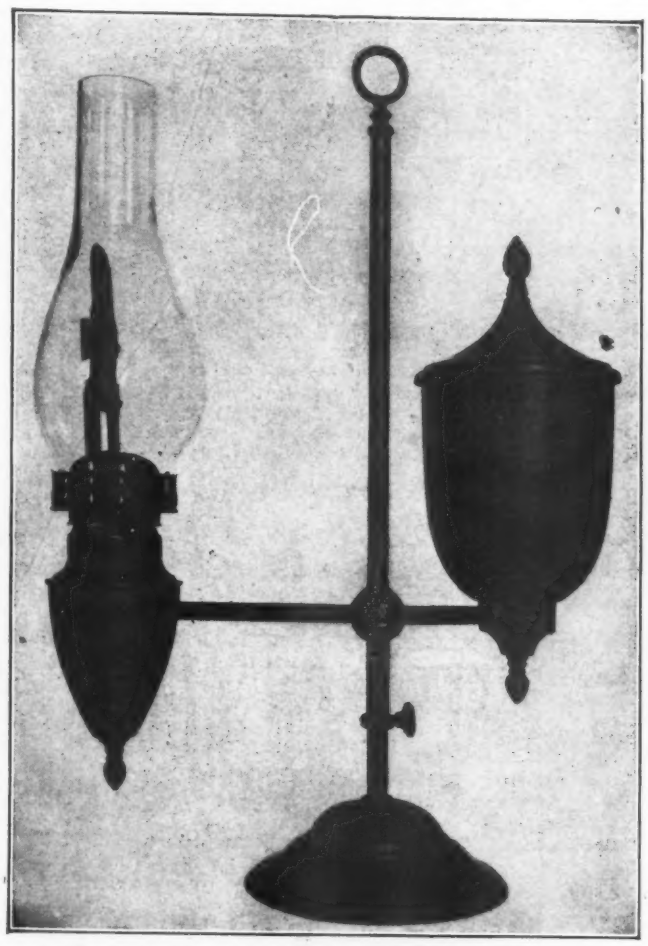
JULY, 1906.

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Sun.	1	12.40 AM	3.40 AM
Mon.	2	1.20	3.40
Tue.	3	2.10	3.40
Wed.	4	No L.	No L.
Thu.	5	No L. FM	No L.
Fri.	6	No L.	No L.
Sat.	7	8.00 PM	9.50 PM
Sun.	8	8.00	10.30
Mon.	9	8.00	11.10
Tue.	10	8.00	11.40
Wed.	11	8.00	12.10 AM
Thu.	12	8.00 LQ	12.40 -
Fri.	13	8.00	1.10
Sat.	14	8.00	1.40
Sun.	15	8.00	2.10
Mon.	16	8.00	2.40
Tue.	17	8.00	3.20
Wed.	18	8.00	3.50
Thu.	19	8.00	3.50
Fri.	20	8.00	3.50
Sat.	21	8.00 NM	3.50
Sun.	22	7.50	3.50
Mon.	23	7.50	3.50
Tue.	24	7.50	3.50
Wed.	25	7.50	3.50
Thu.	26	9.30	3.50
Fri.	27	10.00	3.50
Sat.	28	10.40 FQ	3.50
Sun.	29	11.20	4.00
Mon.	30	12.00	4.00
Tue.	31	12.50 AM	4.00

TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50



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10-Candle Power.

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This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

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2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

JULY, 1906.

Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Light.	Extinguish.
		P. M.	A.M.
Sun.	1	7.30	3.15
Mon.	2	7.30	3.15
Tue.	3	7.30	3.15
Wed.	4	7.30	3.15
Thu.	5	7.30	3.15
Fri.	6	7.30	3.15
Sat.	7	7.30	3.15
Sun.	8	7.30	3.15
Mon.	9	7.30	3.15
Tue.	10	7.30	3.15
Wed.	11	7.30	3.15
Thu.	12	7.30	3.15
Fri.	13	7.30	3.15
Sat.	14	7.30	3.15
Sun.	15	7.30	3.15
Mon.	16	7.20	3.15
Tue.	17	7.20	3.15
Wed.	18	7.20	3.15
Thu.	19	7.20	3.15
Fri.	20	7.20	3.15
Sat.	21	7.20	3.15
Sun.	22	7.20	3.15
Mon.	23	7.20	3.15
Tue.	24	7.20	3.15
Wed.	25	7.20	3.15
Thu.	26	7.20	3.15
Fri.	27	7.20	3.15
Sat.	28	7.20	3.15
Sun.	29	7.20	3.15
Mon.	30	7.10	3.30
Tue.	31	7.10	3.30

TOTAL HOURS DURING 1906.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

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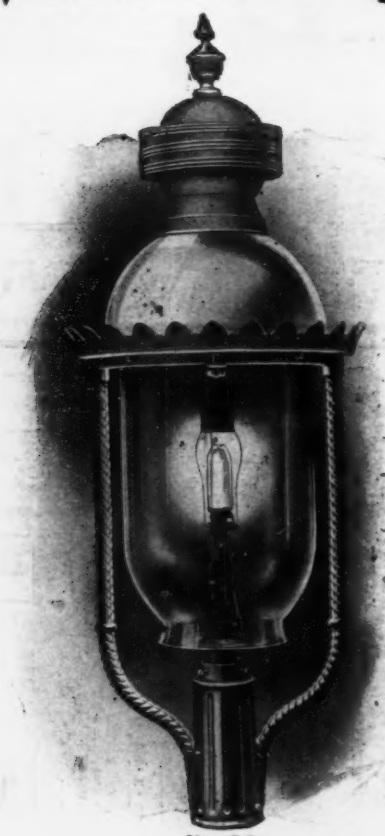

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1 No. 4197 Mantle — Intensive Brand.
1 No. 306 Chimney (air hole).
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Finished in oxidized copper, oxidized brass, etc., 25 cents extra.

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Council Bluffs, Ia. (2d contract).	**Muskegon, Mich.**	**Waterville, Pa.**
Seattle, Wash. (2d contract).	**Nazareth, Pa.** (2d contract).	**Washington, D. C.** (3d contract).

TOTAL SETS TO JULY 1, 1906, = = = = = 618

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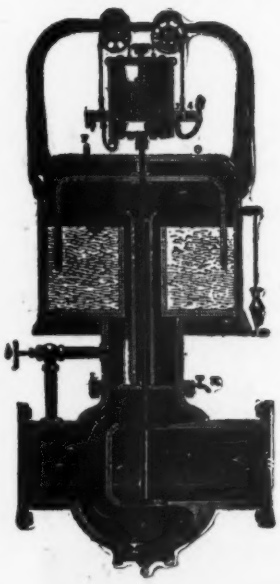

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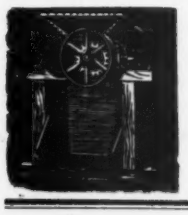

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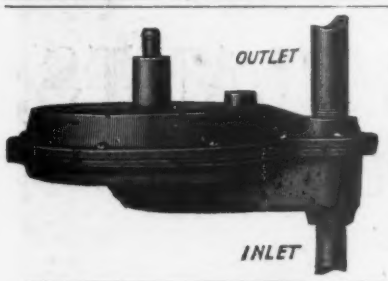

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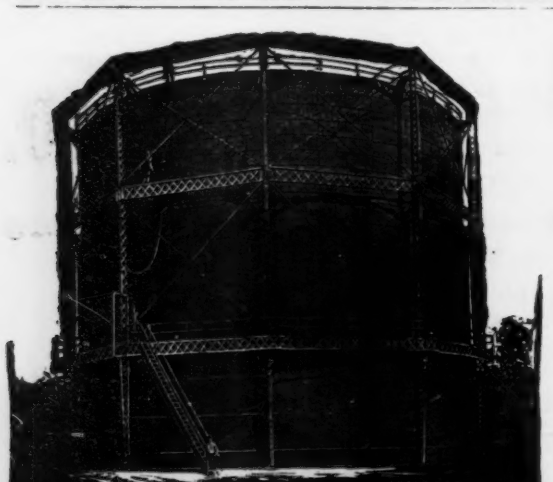

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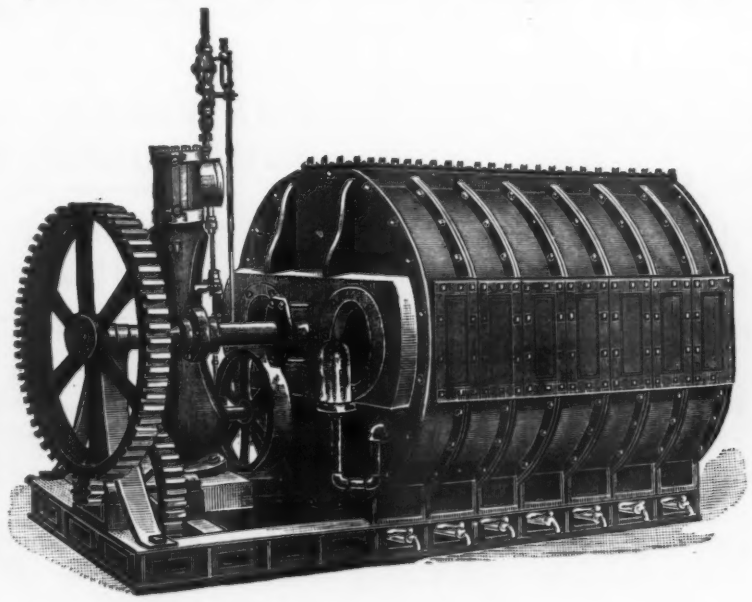

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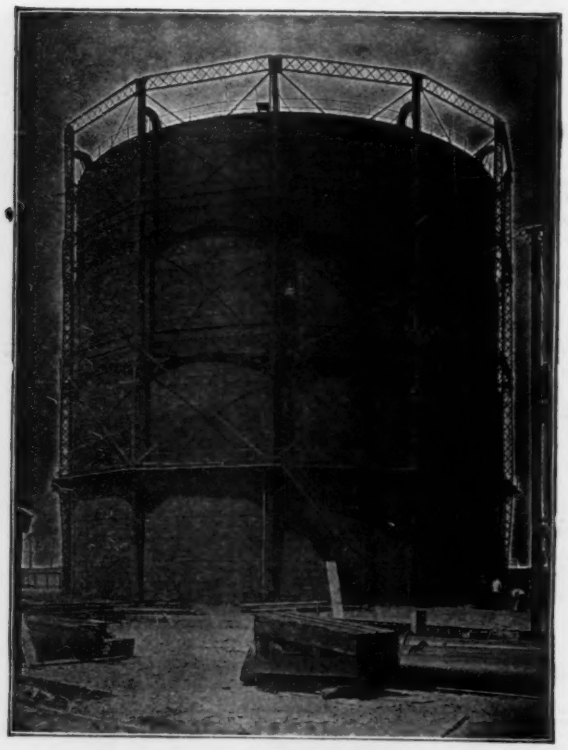

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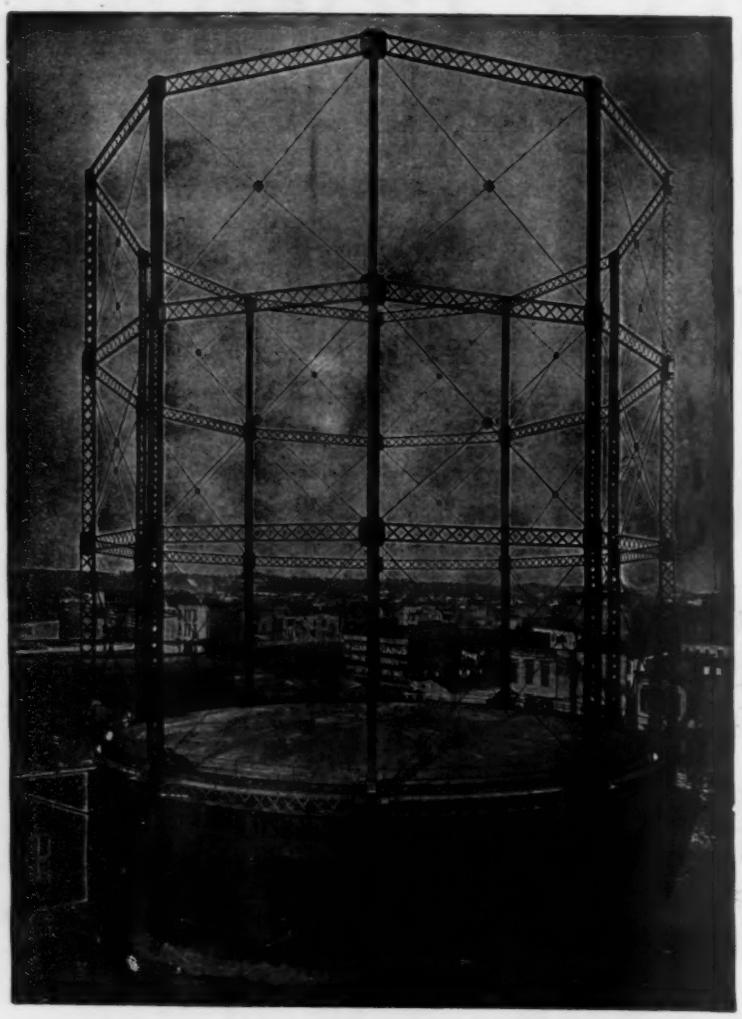

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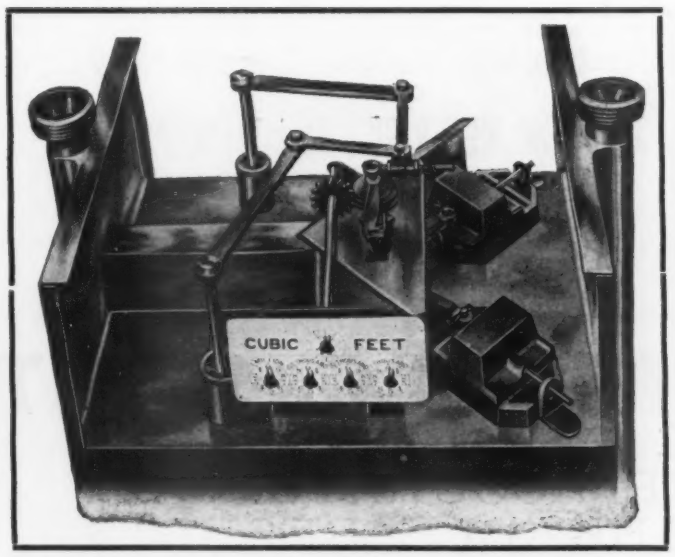

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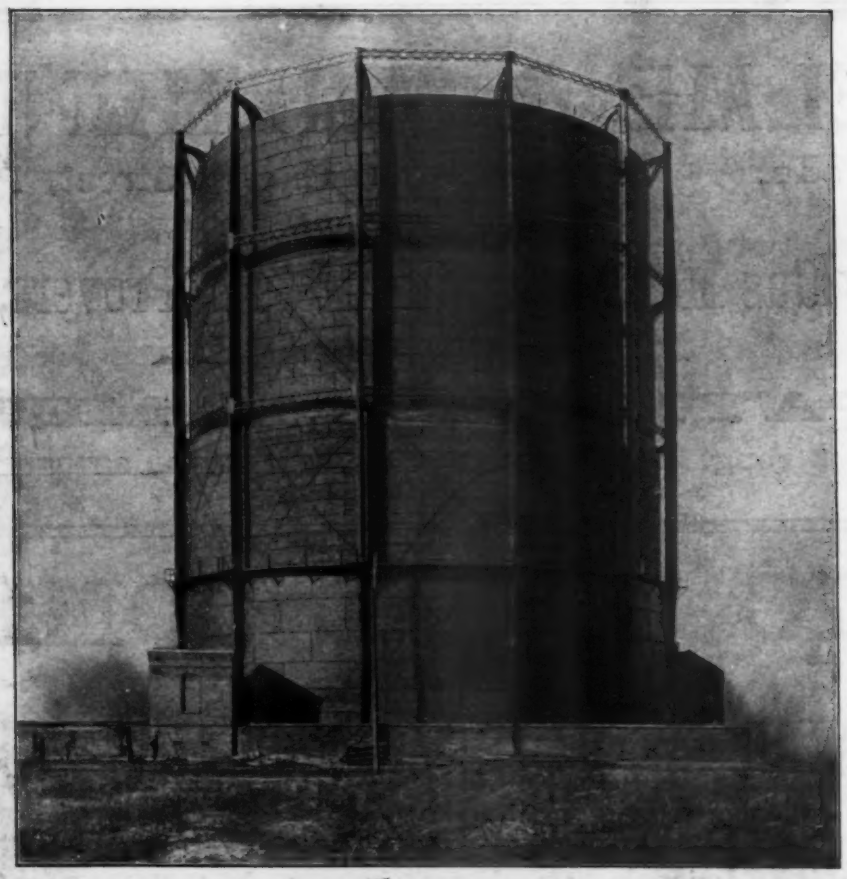

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